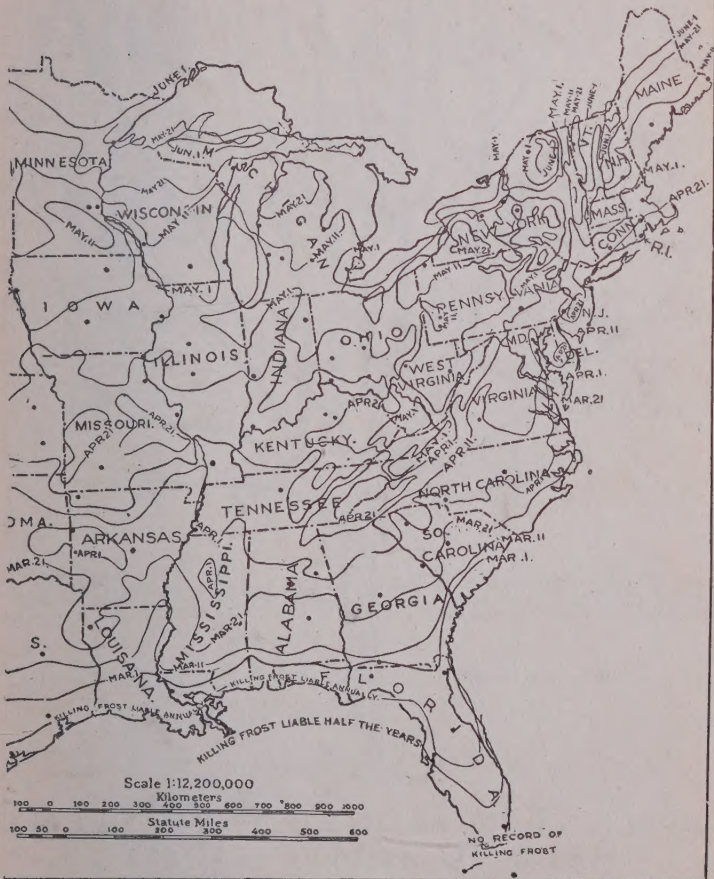


Acadels & Gardeners & Growers Guide



Fine
Fruit
Culture
Cash
Crops





APPLE TREE PRUNED WITH OPEN
HEAD TO ADMIT LIGHT

In the abundance of the yield is the joy and glory of the husbandman.

Audels Gardeners and Growers Guide Volume 3

Presenting in a handy form a wealth of
information, instructions and suggestions on
planting, cultivating and harvesting

Fine Fruits

FOR
Home and Market

TOGETHER WITH

Practical and helpful illustrations—Useful and
valuable tables of requirements

BY

Edward C. Vick



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Foreword—

THE production of choice fruit requires skill and care. It is quite as much an art as that of the painter who is only able to produce a likeness on canvas.

Success depends on the cultivators' knowledge of the various processes of fertilizing, insect and disease control and the more suitable varieties for the conditions under which the crop is to be grown.

Time and money may be saved by learning that which has actually been demonstrated by experience, and for which, in some cases, others have paid dearly.

E. C. Vick.

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Presenting a wealth of information for growers on working, fertilizing, irrigating and draining the soil, including valuable tables for field and garden requirements.

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Giving successful cultural directions for growing each vegetable, arranged alphabetically, and including market gardening.

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Giving successful cultural directions for growing each fruit, alphabetically arranged, including tree surgery and information on cash crops.

GUIDE No. 4—*Beautiful Flowers*

Giving successful directions for the cultivation and propagation of annuals, perennials, dahlias, roses, gladiolas and all other flowers, including shrubs and lawns.


Dedication

Dedicated

To the Encouragement of all Growers

The Author

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Chapter I

PROPAGATION

The foundation of plant growing is the propagation or production of plants. This is true whether the products to be marketed are trees, plants, flowers, seeds or bulbs. This is an age of specialization and many are now engaged in starting seedling plants or rooted cuttings which are sold in large quantities to others who finish the production. Such plants are offered for "growing on." Seedling evergreens and rooted cuttings of ornamental plants are commonly handled in this way.

Plants are produced in two ways—by seeds (or spores); and by buds (or division) of plants.

Propagation by seeds is the common method with annual and biennial plants, and with perennials that come true from seeds or in which the reproduction of the exact parental form is unimportant. This is the method used when variation in the progeny is desired as in the development of new varieties.

In plants propagated by seed, several generations may have to be produced before a uniform strain in the plants can be depended upon from seed.

In obtaining seed for producing stock on which to graft or bud, care must be exercised to get good seed that will grow strong roots. The seeds of wild plants produce the best stock. Many nurserymen, in preference to growing their own stocks, purchase them from the growers who grow them on a large scale.

Spores are the principal reproductive bodies in plants that produce no seeds, such as ferns, mushrooms, etc. They are often so small as to be scarcely seen without the aid of a magnifying glass.

Propagation by buds (or division) of plants consists of various operations which the horticulturist must be familiar with, such as Budding, Cuttings and Grafting, and the various methods employed under each which are described in this guide. Producing plants by any of these methods is called vegetative production.

Chapter II

SOIL CULTIVATION

Oxygen is necessary to the life of roots. Seeds will not germinate without it. That is one of the main reasons why we plow or spade and cultivate the soil, although many suppose it is simply to loosen the soil. Soil must contain sufficient plant food, moisture and air, to make plants grow well.

The soil where crops are growing is constantly in action. Changes are taking place all the time during the growing season. The remains of dead plant and animal matter that the soil contains undergo decomposition, through the activity of microscopic organisms known as bacteria. Through their agency, nitrogen is produced.

Carbonic acid which the plants take from the air aids in the disintegration of the mineral constituents of the soil, making them available as plant food.

Importance of Organic Matter in Soils.—Organic matter is dead and decayed vegetable or animal matter in the soil. It is this that produces the magic soil constituent called humus. Constant cultivation and the growing and harvesting of crops removes the humus from the soil. To keep the soil productive, organic matter must be supplied, no matter how much chemical fertilizer is applied.

Stable or barnyard manure may be applied to the land, or crops of clover, soy beans, vetch, cow-peas, rye, oats, etc., may be grown and plowed under. These supply plant food, render the soil porous and increase its water holding capacity.

A **compost heap** where all sorts of vegetable matter may be piled and permitted to rot, answers as a substitute for manure. All vegetable matter that is free from disease, such as clippings from the lawn, corn husks, vegetable tops, fallen leaves, may be used to swell the pile.

Piling up the material and scattering lime over each layer will hasten decay.

Drainage Promotes Soil Aeration.—Drainage is important in the field and also for pot plants. The outside of the pots should be kept clean. Potting soil should contain sufficient sand and decayed organic matter or humus to make it porous and friable.

The development of roots depends on the amount of oxygen and available plant food which the soil contains, combined with moisture.

Soil Exhaustion.—Growing crops reduce the fertility or plant food of the soil according to the crops grown and the quantities of the various elements the crops contain, which they obtained from the soil.

Through decay and disintegration of soil materials, plant food is constantly being made and added to by snow, rain and the atmosphere, but for abundant crops of quality, the cultivator of the land must aid nature in restoring materials which crops remove from the soil.

Needed Elements.—The elements most needed by plants and most frequently lacking in soils are nitrogen, phosphorous and potassium. Decaying animal or vegetable matter added to the soil supply these in varying degrees. Growing leguminous plants such as clovers, lupins, vetch, beans and peas add nitrogen to the soil. Nitric acid is formed through the roots of plants from nitrogen in the air, through the agency of bacteria.

A crop of clover or beans will leave the land richer in nitrogen than it was before. The soil, however, will need phosphoric acid and potash and possibly some additional nitrogen.

Nitrogen is supplied through the means of chemical salts some of which are now obtained from the air such as urea, leunasalpeter, nitrate of lime, this latter containing a large percentage of lime valuable for lime-loving crops. Nitrogen is also obtained in the form of sulphate of ammonia and nitrate of soda.

Organic matter, animal and vegetable matter, undergo nitrification when weather conditions are favorable and the ground is warm and aerated. Rain and snow supply some nitrogen. Drainage and cultivation assist nitrification.

Phosphorous, or "phosphate" as it is generally spoken of, may be obtained through the use of acid phosphate, wood ashes, ground bone, etc.

Potash is obtained in the form of muriate and sulphate of potash.

Lack of nitrogen is indicated by pale green foliage and weak growth. Excess of nitrogen is shown by rapid growth, large leaf and stalk growth, and few flower buds, the strength of the plant going to stem and leaf growth.

Want of phosphoric acid is indicated by light crops of shrunken seeds of poor quality. Lack of potash results in small crops of poor fruit.

Crop rotation is advisable, as some crops use more of the plant food element than others. The following crop may most need the food element which the preceding crop used the least. Rotation reduces the danger of plant diseases and insect attacks.

Mulching aids in keeping the soil moist. A mulch shades the soil from the hot rays of the sun, keeping the surface of the soil cooler. The mulch being a poor conductor of moisture doubly checks evaporation.

Lawn clippings, hay, straw, leaves, manure, spent tan bark and similar materials are used for mulching.

Cultivation.—In recent years much has been said about the importance of keeping growing crops protected with a “soil mulch.” This seems to be the use of a new term to get growers to resort to plain, old-fashioned cultivation. Stirring the surface of the soil, keeping it from forming a crust and always in fine condition, keeps down weeds which rob growing crops of moisture and plant food. This operation also breaks, to a considerable extent, the capillary attraction to the surface and thus prevents evaporation.

A loose surface soil keeps the soil below cooler and stirring the soil is also beneficial because of the air that is admitted.

Rain forms a crust on the soil and if this is broken by cultivation after rain, the crop will be benefited.

Cultivation should be shallow on crops whose roots grow close to the surface.

Sheltered Location Desirable.—Winds increase the transpiration of plants. Plants exposed to high winds will require more moisture in the soil than plants that are sheltered. That is one reason why wind-breaks are desirable, or for having gardens in sheltered locations.

The subject of Soil Cultivation including Fertilizing, Irrigating, Draining and Working the soil has been thoroughly treated in Volume I of these Guides.

Chapter III

SUNLIGHT, SHADE AND WATERING

Sunlight and Shade.—Young seedlings, plants that have just been transplanted and newly made cuttings that have not formed roots—must be protected, that is, shaded from the sun.



CUTTING BED PROTECTED BY LATH SCREEN
Overhead Irrigation Above

In outdoor culture, lath screens are used and they can be used, at times, in the greenhouse. Sheeting or canvas will be more convenient for greenhouse use. Shading the glass of greenhouse or hotbed with whitewash is frequently resorted to. The lath shade can be laid on the glass outside. Where there are high winds, it will be necessary to fasten the shades down in some way.

Cuttings in the propagating bench or open ground are sometimes shaded by boards placed over them, sufficiently elevated.

Lath shade is particularly good as it does not obstruct all the light.

Plants that are well rooted and in good growth need full sunlight, except in the case of plants native of shady places, such as ferns.

Insufficient light causes plants to grow tall and spindly; insufficient development of chlorophyl, which is the green grains in the cells of the leaf and other parts exposed to the light, gives the foliage a whitish color. This lessens the food formation causing reduced leaf development, and transpiration, tending to soft, watery growth with poor color and flavor. It prevents pollination of the flowers and reduces fruitfulness.

Close planting restricts light and produces inferior crops. Exhibition plants, vegetables or fruits should be given ample room. Greenhouses are now built with sash bars far apart; large panes of glass are used so there may be as little shade as possible cast upon the plants. The electric light has been used in forcing crops.

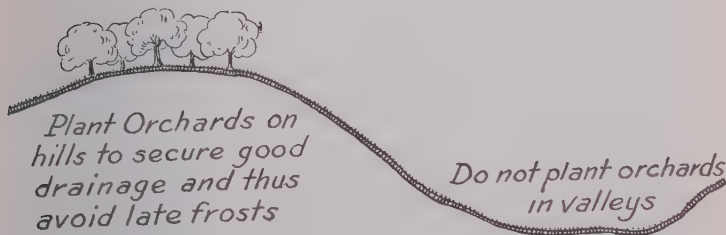
One of the objects of pruning fruit trees is to admit light into the whole head of the tree, so that fruit bud formation may not be restricted and the fruit may be well colored.

Blanching of vegetables such as is common in celery growing is to make them more tender. By excluding the light from the plants the chlorophyl almost entirely disappears. The plants are banked up with earth, paper or boards so that practically all light is excluded. Close planting has somewhat the same effect.

WATERING

Water and Watering.—The control of water is necessary to successful plant production. Not only must water be applied as needed, but it is equally important that surplus water be promptly allowed to drain away. The subject of drainage is fully treated in Volume I of these Guides.

In selecting a location for growing operations, be sure that there is an ample water supply. If drainage is not good, see that it is remedied at not too great cost.



Excessive water in the soil kills the roots of plants.

Oxygen in the soil is absolutely necessary to the life of the roots of plants. When the soil cavities are filled with water, oxygen is excluded except the insufficient quantity in the water. This, if continued, causes the roots to decay and seeds will not grow under such conditions. This is one reason why good drainage is so important.

With potted plants good drainage is obtained by mixing sufficient sand with the soil to make it porous and through which

water will pass freely. The mixing should be thorough. Pieces of broken pots are used in the bottom of the pots in which the plants are potted, where extra good drainage is required.

When plants are watered they should be given copious waterings, without overdoing the matter. Frequent slight waterings are not desirable.

Plants under glass should be watered in the morning, also most plants in the open ground. Some plants, like Japanese iris, that delight in a cool wet soil, may well be watered at night when there will be less evaporation and the water will soak down deeper in consequence.

Plants in active growth require more water than plants that are growing slowly. Dormant plants require very careful watering.

Some plants require more water than others. The calla lily and cyperius alternifolius will stand considerable water, while cacti and other plants native of arid regions, require but little water and can be injured and killed by too much.

Water sprouts on fruit trees may indicate want of drainage as they are sometimes caused by an excess of water in the soil. They grow from the main branches of fruit trees that are unhealthy or on poorly drained, heavy soils. They may also be caused by heavy pruning.

Cracking of fruits and vegetables is often caused by too much water or poor drainage. Tomatoes, cabbage, apples and others are frequently troubled in this way.

Moisture in Atmosphere.—Excessive moisture or dampness in the air is injurious to plants as it interferes with transpiration. If continued, fungous diseases result. Careful ventilation and watering under glass are necessary. Orchard trees must be planted sufficiently far apart to allow good circulation of air between them to insure proper ventilation.



ROOTED CUTTINGS IN FOREGROUND

Cuttings in rear shaded by lath

Heat and Transpiration.--Where the heat is excessive, plants wilt, because of excessive transpiration. Transpiration is the term used to express the discharge of water through the leaves or other parts of plants. The action is somewhat similar to the perspiration of man.

If the soil is dry, wilting may occur at a normal temperature. Where the heat is excessive, and the water supply normal, the

roots may be unable to supply the plant with sufficient water and the plant will wilt.

Unless the heat has been sufficient or prolonged enough to destroy the protoplasm, which is the soft nitrogenous lining or contents of the cells, the plants will recover when proper temperature is restored and water supplied. Wilting, however, is to be avoided where possible.

Lack of Water.—Where there is not sufficient moisture in the soil and the air also is dry, excessive transpiration occurs which retards growth and clogs the pores (stomata) of the leaves with mineral matter drawn up from the soil, resulting in fungous diseases and death. Insufficient moisture retards growth. Plants that have enjoyed ample water quickly suffer from drought.

House Plants.—The dry air of superheated and poorly ventilated living rooms is the reason house-plants drop their leaves in winter, even where other conditions are favorable. A moister atmosphere is better for plants as well as for human beings. Where there are radiators, a water container may be had that hangs down behind them. This kept filled with water, will evaporate enough to keep the air moist. A can of water suspended in a hot air register will produce the same result.

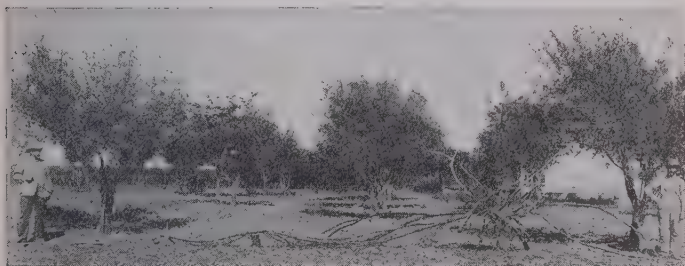
Drought hastens maturity in annuals as an annual's tendency is toward flowering. Rhubarb runs to seed early in dry seasons, also spinach, lettuce and other plants. In excessively dry seasons the seed crop may fail.

Crisp, tender, desirable vegetables such as radishes, celery and others are due to ample soil moisture. Radishes grown on hard, dry soil, where the growth is slow, will be hard and hot in flavor.

Chapter IV

ROOTS, STEMS AND BUDS

Roots.—Plants to flourish and yield abundantly must be well supplied with roots, roots that are well branched, having numerous fibrous rootlets. Removing the growing point of a root or stem, encourages the development of growth farther back.



BEN DAVIS APPLE TREE

Showing root spread of 26 feet on the left and 10 feet on the right.—U. S. D. A.

Transplanting has the effect of pruning the roots, causing a more compact root system, which is of particular advantage where plants, such as young trees from a nursery are to be transplanted, later on.

Pricking off young seedlings, that is, transplanting from the seed bed where they started, to another position where they will have more room, develops additional roots, so that they will better stand the next transplanting.

Nursery trees should be transplanted once or twice before they are sold for planting in their final position. As a substitute for transplanting, nurserymen sometimes prune the roots by a horse drawn implement which has somewhat the same effect as transplanting.



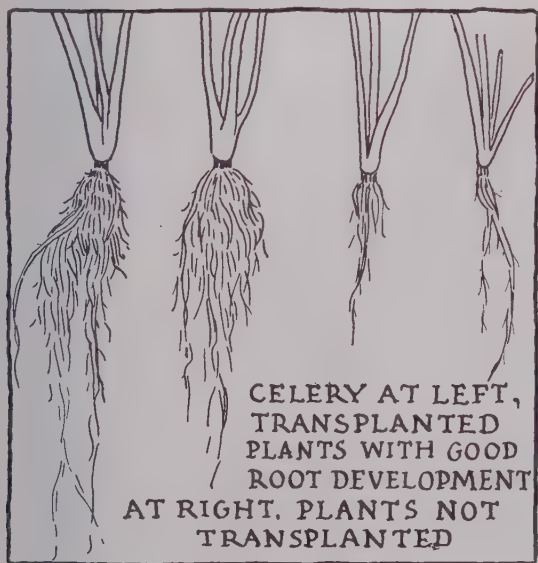
BEN DAVIS APPLE TREE

Part of the root system

Roots of upright growing plants usually extend horizontally farther from the trunk or main stem than the branches. In vines or trailing plants the roots often exceed the length of the branches.

Distance Apart to Plant.—When well developed plants or parts of plants, as foliage, flowers, fruits or roots are desired,

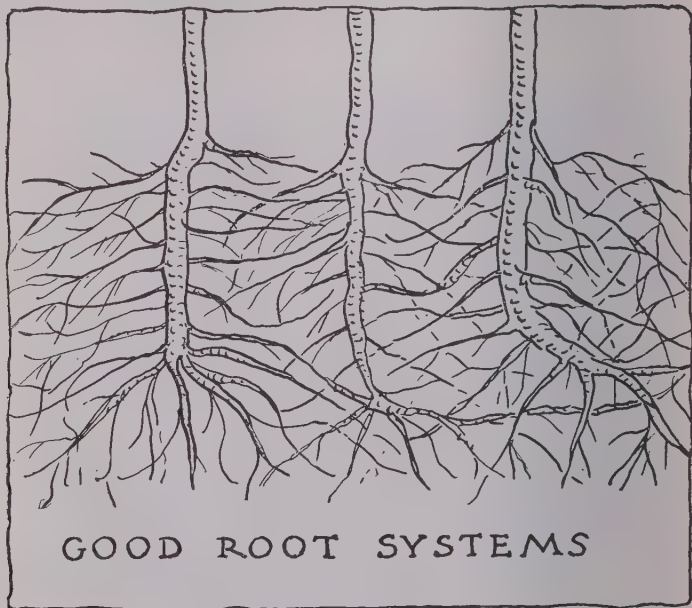
the plants should be spaced so they will not interfere with each others' root or leaf development. If, however, the largest crop from a given area is wanted, regardless of the appearance of the plants as with such crops of oats, wheat or other crops, the planting may be close.



Importance of Leaves.—Both stem and root development depend on the number of leaves the plant bears. It is the leaves that transform the energy of the air and sun into plant tissue.

Plants grown from seed to obtain new varieties having large leaves will have superior root development, indicating great ability to withstand drought.

Leaf crops such as lettuce, spinach, cabbage, etc., should be given cultivation to best promote moisture in the soil, including frequent surface tillage and if possible artificial watering.



Flower buds and leaf buds are located at the apex of the stem or in the axil of a leaf. Flower buds are distinguished from leaf buds by location and appearance. To be able to distinguish them enables the fruit grower to determine his crop.

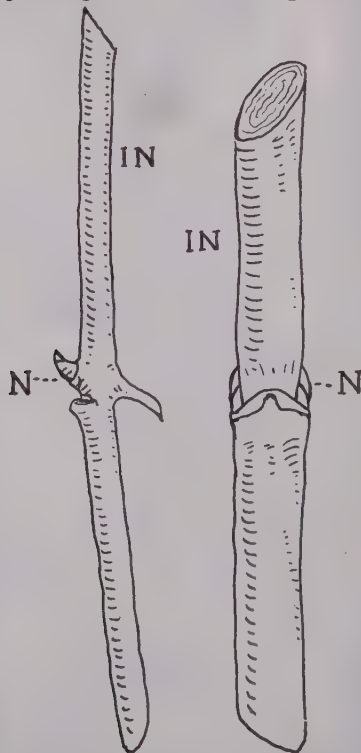
In the peach and apricot and some varieties of plum, the flower bud is usually on each side of the leaf bud, in young shoots of bearing trees. In the apple and pear, the flower buds are usually formed on the short, thick, crooked branches from



FILBERT
Nut and foliage

wood three or four years old. In the cherry, peach and apple, the flower buds are thicker and more rounded than the leaf

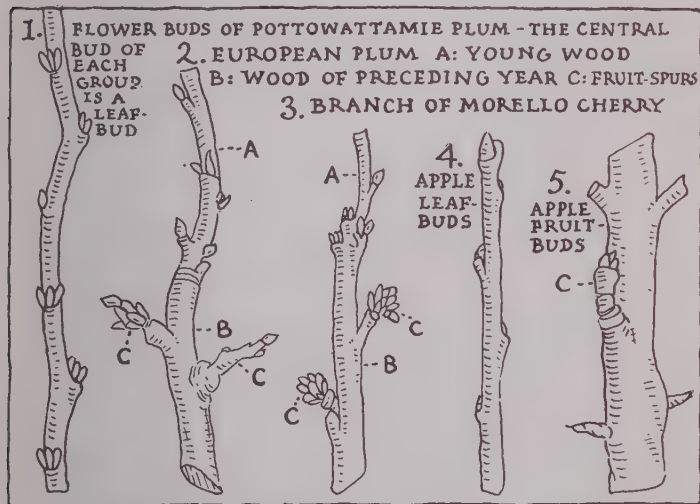
NODES OF PLANT STEMS



IN—INTERNODES N—NODES

buds. It is important in pruning to know the location of the flower buds.

Nodes and Internodes.—The stem of a plant is developed in sections. Each section consists of one or more leaves attached to the end of a part of the stem, called the distal end, which means the farthest point of the stem. The part of the stem to which the leaves are attached is called a node and the part between the nodes is called an internode. It is at the nodes that



Success in budding work depends largely on a thorough knowledge of the different kinds of buds

lateral growth starts and where roots first start in cuttings and layers, but not always.

Cuttings of geraniums formerly were always made just below a node with the node as the base. A geranium cutting will root quite as readily if the base of the cutting is the middle of an internode and this is true also with some other plants.

Selecting Cuttings and Cions.—The terminal bud is usually the most vigorous and the vigor of the buds generally diminishes as they recede from the terminal bud. Where growth has been rapid the weaker buds are the lateral buds. Cions and cuttings should therefore be taken from sturdy growth.

Encouraging Plants to Flower.—Plants form flower buds only when they contain reserve food. This is true of plants grown for flowers or fruits. Rapidly growing plants, such for example as dahlias that have been too heavily fertilized and grown on rich soil, will produce prolific plants, stems and foliage, but few flowers. The same plants on an ash heap will produce better flowers. This fact must not be taken to mean that good soil and fertilizers are never needed.

In some cases rapidly growing plants are checked by pruning, such as pinching back the shoots of dahlias and also by permitting only one main stem to grow. Withholding water, giving only sufficient for slow growth is another method of checking growth. The flower buds of fruit trees are formed during the dry period of the preceding season, when the lessened supply of water, heat and light favor food formation.

Plants must be protected from the attacks of insects and fungus so they may enjoy full leaf development to help store food. Sufficient but not too much plant food should be supplied.

Seedling trees can be brought into flower early by pinching back the young shoots early in the summer before the season when the flower buds are formed.

Chapter V

REST PERIOD

Annual and biennial plants start from seeds, develop, flower, produce their seed to perpetuate their kind, and die. With other plants, active growth is followed by a period of rest.

Woody plants prepare for the rest period by the thickening of the cells; part of the rudimentary leaves change to bud scales, inclosing the growing point.

In deciduous trees and shrubs, that is, those that drop their leaves when at rest, the needed materials in the leaves are withdrawn to the woody parts and the leaves drop. It is this process and not frost that causes leaves to assume their brilliant autumn hues. In many plants at this time the root hairs die.

In perennial plants, the nutritive matter in foliage and stem is drawn down into the parts underground. That is why plants like tulips, hyacinths, dahlias and gladiolus should not have the tops removed until they are quite well dried up, whether the plants are left in the ground or dug for safe winter storage. In the South, dahlias and gladiolus may remain in the ground over winter where cold weather is not severe.

In the dormant condition plants are able to stand cold and dryness that would be fatal when in active growth. Most

mature trees grow very little after the middle of summer in our climate.

Prolonged Growth.—Late fertilization and cultivation and sometimes wet weather prolong growth which is not desirable. Unless the wood is properly matured when cold weather arrives, winter killing is likely to result.

All plants, like animals, require a period of rest. Plants in warm climates take their rest. In the North, trees that form buds in summer are unaffected by the warm weather and refuse to start until it is safe, early the following spring. Greenhouse plants require a season of rest. This is accomplished by lower temperature or less water or both.

Hardiness.—Hardy is a term that is used indiscriminately and is confusing. Hardy is sometimes used to describe a plant that will stand rougher treatment than others, although it may not be able to withstand freezing weather. It is also used to describe plants that will stand more heat and drought than others. The aspidistra is said to be a hardy pot plant, because it stands wet or drought, high temperature and low in living rooms, but freezing would be fatal. Some apple and peach trees are hardier than others and will grow in climates where other varieties will not. A plant may be hardy in Maryland where it will survive the winter out of doors, and tender in New England where exposure to winter weather will be fatal. Generally, a plant is hardy where the growing season is long enough and warm enough to permit it to complete its normal growth.

After a period of rest plants start with renewed vigor, as an animal awaking from sleep. Buds and seeds start vigorously with the first warm weather of spring.

Some plants taken up from the garden in the autumn, such as rhubarb and lily of the valley, cannot be forced well under glass until they have been frozen and permitted to have a rest. Some seeds of hardy plants do not start well at a high temperature, but when first placed in a lower temperature will germinate quickly. In the South, a second crop of potatoes is produced by placing the tubers in cold storage soon after they are harvested, after which they are replanted.

In the South where tulips and hyacinths cannot be successfully grown in pots in the late autumn, they are potted and put in dark cold storage where the temperature is kept low, but above freezing, where the roots form. When the pots are well filled with roots, or pot-bound, they are placed in the light in moderate temperature where they break into flower.

Evergreen trees and some others sometimes suffer from going into winter after a drought. If the ground is very dry in the late autumn and then freezes, the winter winds and early spring winds, if the season is dry, are likely to kill the foliage. Where possible, supply water liberally before freezing weather. Privet hedges are likely to kill back under such conditions.

Evergreens may also be killed by unduly warm weather in the early spring when the earth is cold and the roots inactive. The winds are high at this season and excessive transpiration may mean the death of the trees.

Mice.—Mice are likely to be troublesome on sod land when it is covered with snow. Remove all grass around the base of trees in the autumn. Removing or packing the snow around the tree trunks is a preventative. The base of the trees may be wrapped with wire netting, which should be removed in the spring. Mice and rats are sometimes troublesome where seeds are stored.

Rabbits may be troublesome in winter. Smearing the trunks of trees with blood is a general remedy. Wrapping the trunks with wire screen affords protection. Boys with traps can also quickly rid the place of rabbits.

Gophers.—Place corn, soaked in a solution of strychnine and water in their holes.

Woodchucks, moles, gophers, rats and mice can be destroyed with cyanogas, a dust, which is blown into their holes with a duster, made for the purpose. When exposed to the air, the powdered material gives off hydrocyanic acid gas which is deadly to the rodents and kills them quickly. Outdoors it may be used safely, with caution. In buildings it should only be used by one who knows just how or by a professional who is licensed, as it is equally deadly to human beings who may be in the building.

Chapter VI

PROPAGATING METHODS

Plant propagation is the reproduction or multiplying of plants through the skill of the cultivator.

As previously stated, plants are propagated by two methods: (1) seeds or spores, and (2) division of plants. This is true of all plants. Seeds are the result of sexual fusion, and the resulting plants may or may not closely resemble the parent.

By division of plants a bud is used in place of a seed and the result is simply a continuation of the parent growth, and except in rather rare cases, is practically the same as the parent.

Sport.—A sport is a bud variation from the recognized character of a plant. A branch of a plant sometimes produces leaves of different form or color, or flowers of a different form or color from the parent. Such occurrences are called “sports” or “breaks” from the original variety. These are perpetuated, where that is desired, by budding or cuttings as will be explained later on.

Seed Propagation.—Annual and biennial plants, and perennials that “come true” or very closely resemble the parent when grown from seed, are usually reproduced by seed propagation. That is, by planting seeds. This is the necessary method when attempting to produce new varieties.

Fine seeds should be planted in well-drained soil which has been carefully prepared, and made fine, with all trash removed. For seeds sown in seed pans or boxes it will be well to use good



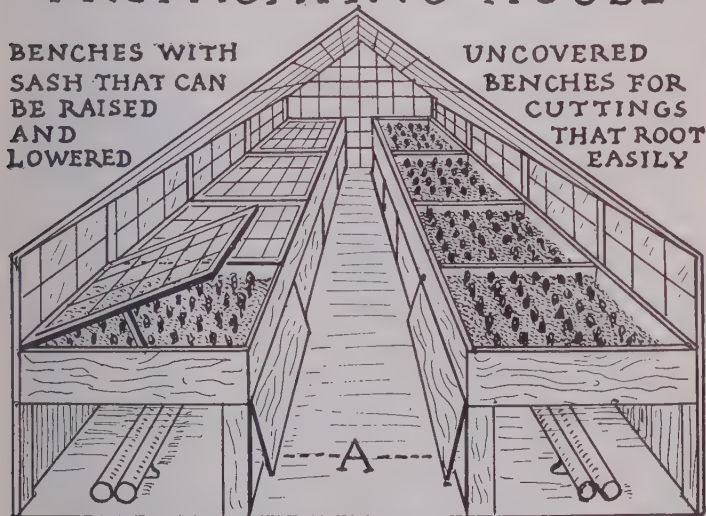
READJUSTMENT OF PLANT WHEN SEED IS SOWN TOO DEEP

loam and mix with it from a quarter to a half of sharp sand. Have the soil damp, but not wet. Firm the soil well about the seeds.

The soil in which seeds are planted should not be allowed to dry out. Over-watering must also be avoided as that is likely to cause damping off of the young plants.

Planting Seeds.—Seeds should be planted only deeply enough for them to obtain needed moisture for germination. The plantlet that is started from a seed must force its way through the soil to the surface. The shallower the seed is planted the sooner will it appear above the surface.

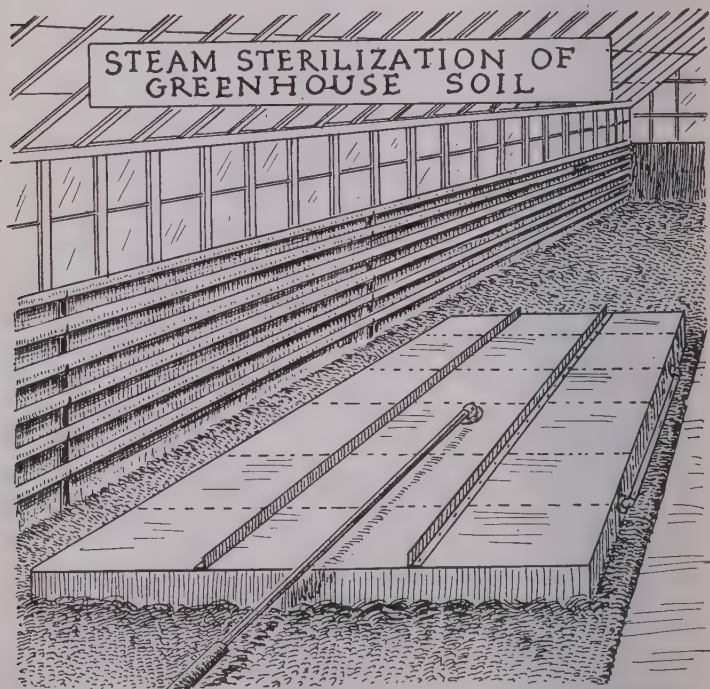
PROPAGATING HOUSE



A. VENTILATING DOORS THAT ARE OPENED TO REDUCE HEAT IN PROPAGATING BED OR CLOSED TO RAISE IT

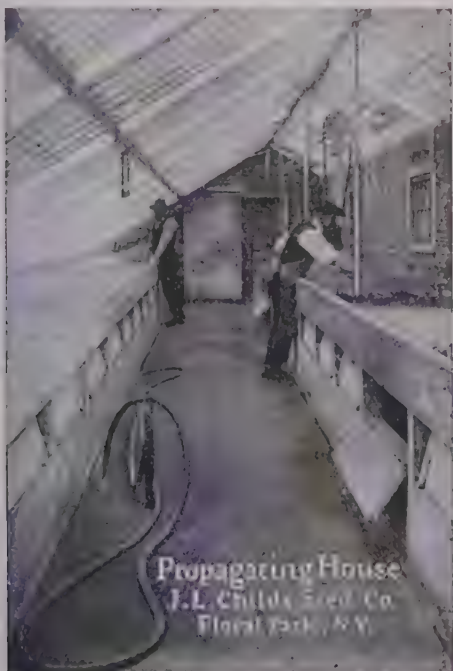
Fine seeds such as lettuce and celery and seeds of weak growing plants like carrots, should be planted early in the spring to insure proper moisture or should be given water artificially. Still finer seeds, such as the petunia, which is about like dust, should not be covered, but sown on a level surface and pressed down lightly, and then must be kept moist by careful spraying.

Boxes or pots containing delicate seeds should be covered with a pane of glass or the soil lightly sprinkled with imported granulated peat moss rubbed very fine, to help retain moisture. They must be shaded from direct sunshine until the plants are up.



Soaking seeds in water before planting will hasten germination. Judgment must be used in this operation. There are so many kinds of seeds, all so different, that no general rule can be given.

Spores.—Ferns are grown from spores sown on the surface of fine soil of a propagating frame in which the air is kept moist and the surface of the soil never becomes dry. The spores may be sown on soil in pots or pans over which a glass bell jar is placed. To prevent sudden changes of temperature a second and larger bell jar is sometimes placed over the first. The bell jar prevents evaporation of the moisture, keeping the soil from drying out.



Division of plants is the method of reproduction when the exact character of the parent is desired. Varieties of fruits, ornamental trees, shrubs and flowering plants are reproduced in this manner. Some plants, like the horse-radish, rarely produce seed and are multiplied by divisions. Some perennial plants like aspidistra are reproduced by this method, also rhubarb and other plants.

Cuttings.—Parts of plants such as a cutting of the stem or “slip”, under right conditions will form roots and become a complete plant. Such plants are spoken of by florists as “own root” plants. Geraniums, coleus, roses and many other plants are reproduced by this method.

Root Cuttings.—A cutting of a root of some plants will develop a bud which will form a plant. These are called root cuttings.

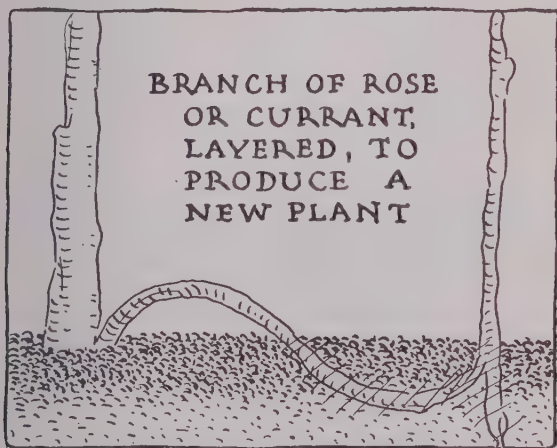
Budding consists of removing a bud from the plant to be reproduced, inserting the bud properly on the stem of a less desirable variety and encouraging growth from the bud which is to develop.

Layering.—Propagation by layering is really making artificial stolons. The part used for the new plant is nourished by the parent until it has developed roots of its own sufficient for its own support. This method also includes propagation by approach grafting, by suckers and by stolons.

Woody plants that do not readily form roots are more certainly rooted by layering. A longitudinal slit is cut half way through the stem and about two inches long, in the part of the stem that is to be buried. This is drawn down to the earth,

pressed into a shallow drill made for the purpose and covered with sufficient earth to keep it in place until roots are formed.

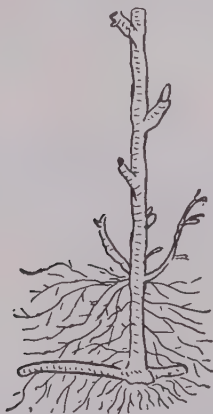
Mound Layering.—Another method is to ridge up the soil about the branches as is common practice with gooseberries,



and which is called mound layering. In either method the terminal stem is left uncovered, extending beyond the covered portion.

Suckers are shoots that are produced from the roots or underground stems and develop young plants around the parent as with blackberries, raspberries, bamboos, etc. All that is necessary is to cut the plant root so as to separate it from the parent and transplant.

Stolons are trailing or reclining and rooting shoots. Rooting may be hastened by covering the branch with soil. When well rooted the young plants are cut from the parent branch. Black raspberries root from the tips of the canes when covered



**SUCKER PLANT
OF RED -
RASPBERRY**

with soil. Also the Columbian raspberry, which is a purple variety. The houseleek which is an interesting plant, multiplies very rapidly from stolons. This plant is commonly called hen-and-chickens. It is particularly good for edgings. Runners of strawberry plants are stolons.

Crown divisions is the method of propagation with dahlias and other plants. The tubers are taken up and the crown cut into as many parts or single tubers as possible, so long as there is an eye or bud on each, planting each division separately.

Dahlias are also propagated by means of cuttings. The tubers are started into growth early in the season, usually in February, and cuttings are made from the stems, and these are inserted in sand in the propagating bench, where they soon root.



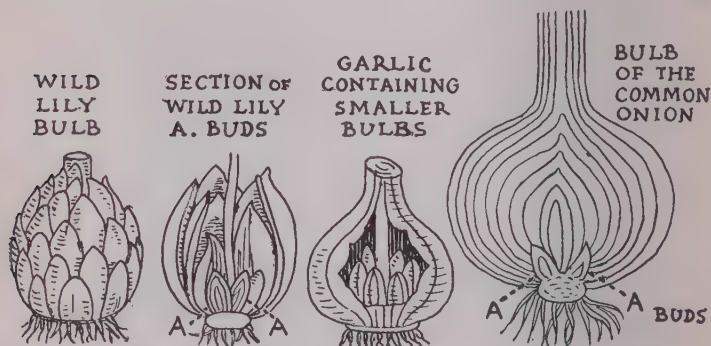
ROOTED RUNNER OF STRAWBERRY

Approach grafting is chiefly used for propagating plants that are difficult to propagate by other methods. This operation is performed during the early growing season. The parts are bound together with raffia and if the operation is in the open air, the parts are protected by grafting wax.

The cambium layer is the inner bark, next to the new wood, in which new cells form rapidly, the inner cells are added to the wood and the outer to the bark, thus producing the annual layers.

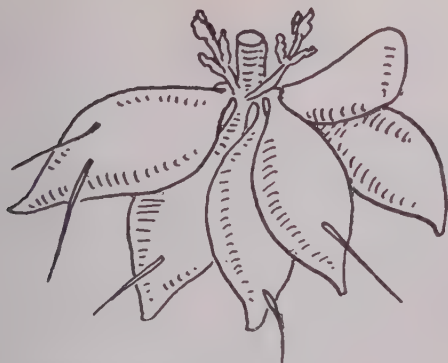
In approach grafting, a shaving reaching into the cambium layer is removed from the stock and also from the graft on the sides toward each other. The cut surfaces are made to fit as nearly as possible, and tied with raffia and allowed to remain until they unite.

The cion is then cut off gradually below the union so as to avoid a check in growth. The stock is then cut off above the union. This is a rather delicate operation requiring skill and care to perform successfully.

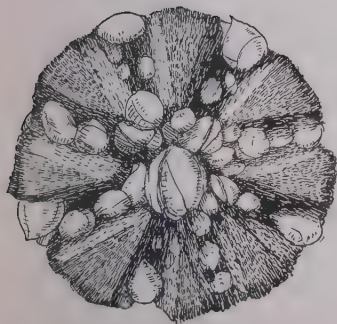


Bulbs include bulbs, small bulbs (called bulblets), corms and tubers. A bulb is a subterranean stem, covered with scales which are the bases of leaves, such as the lily. Each scale when planted will root and form a plant. The crocus bulb is a corm, that is a solid bulb, which is a thick root stock. The gladiolus bulb is, strictly speaking, a corm. A tuber is a thickened portion of a subterranean stem or branch, provided with "eyes," or buds, as in the potato.

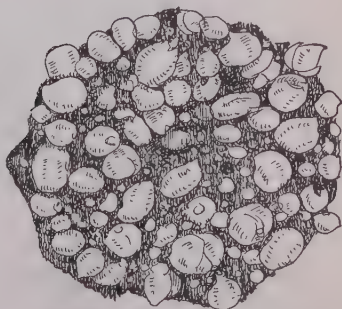
A terminal bud is inclosed in the bulb on a very short stem. Food is stored in the thicker scales, and in their axils are smaller lateral buds. The terminal bud, as a rule, develops a flower and dies. The lateral buds may develop into flower buds for the next season.



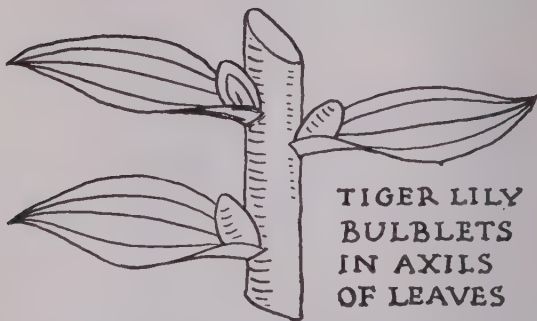
DAHLIA TUBERS.
SHOWING BUDS OR "EYES".
IN DIVIDING, EACH TUBER
SHOULD HAVE AN EYE



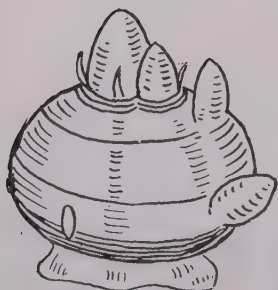
HYACINTH BULBLETS
FORMING ON
NOTCHED PARENT



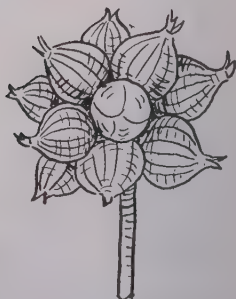
HYACINTH BULBLETS
FORMING ON
SCOOPED PARENT



**TIGER LILY
BULBLETS
IN AXILS
OF LEAVES**



**CROCUS CORM
SHOWING
SMALL CORMS**

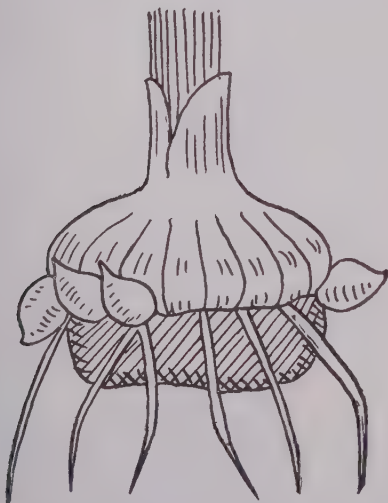


**TOP ONION
PRODUCED ON
TOP OF STEM**

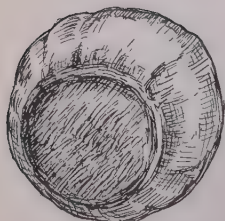
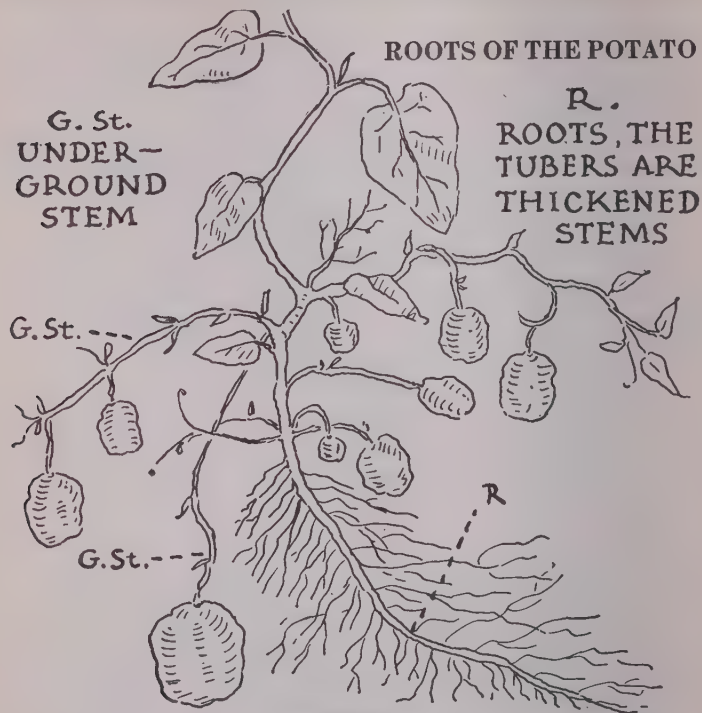
Bulblets form at the base of old bulbs as in the gladiolus, or in the axils of the leaves as in the tiger lily, or at the apex or top of the stem as in the top onion.

Bulbs and bulblets are planted where they are to grow. Tubers, such as the potato may be cut into pieces containing one or more buds or eyes each.

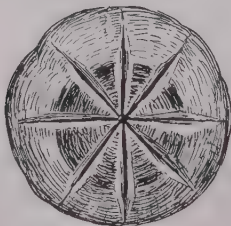
Storing.—Bulbs should be stored in a moderately dry, cool place, free from frost, over winter and planted the following spring.



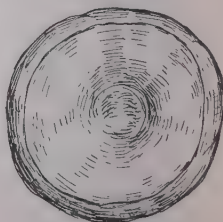
GLADIOLUS CORM.
NEW CORM FORMED
OVER OLD. SMALL
CORMS BETWEEN
THE TWO



HYACINTH BULB
SHOWING BASE



HYACINTH BULB
NOTCHED FOR
PROPAGATION



HYACINTH BULB
SCOOPED FOR
PROPAGATION

Chapter VII

CUTTINGS

A **cutting** is a portion of a plant, which, when treated in a certain manner, will form roots of its own and make an individual plant. The plant will be the same as the parent in all respects and will produce the same kind of flowers and fruit as the parent.

Plants propagated by cuttings, by layering, or by divisions of the plants, are said to be propagated or reproduced vegetatively. Many plants produced vegetatively can be grown into salable plants quickly and advantageously by grafting or budding.

Cuttings should be made with a very sharp knife.

Some fruits usually grown from cuttings include bananas, currants, dates, figs, filberts, gooseberries, grapes, mulberries, olives, quinces, pineapples, pomegranates. Other fruits which may be propagated by means of cuttings, although usually propagated otherwise, include apples, citrus fruits, pears, plums and various tropical fruits.

It is not generally known that the top which is cut off a pineapple fruit, will root, if set on a pot of sand, kept warm and the soil moist but not wet; and may be grown in a warm room, or out of doors during hot weather of summer. Care must be taken not to get water in the foliage which is shaped so it will hold water. The water cannot run off, unless the plant is turned upside down, and the water, if allowed to remain, will rot the crown and kill the plant.

Where the pineapple is grown commercially, the cuttings used for propagating are "suckers," offshoots appearing in the axils of the leaves, which sometimes take root while still attached to the parent. They are taken off, when young and rooted in soil. The date is treated in the same manner.

Best Kind of Cuttings.—The younger, matured growth is usually best for cuttings. Some cuttings root best when made below a node, that is the part to be inserted in the soil. Cuttings of other plants root equally well when the base is made at an internode. Cuttings are said to have a "heel" when a portion of the parent stem is attached to the base. The conifers and some other plants root more quickly when cut with a heel—a small portion of the wood of the previous year—at the base.

Cuttings of some plants, particularly dahlias, that are to be grown for tubers, should be made just below a node.

It is better for beginners to make their cuttings with the base just below a node or bud, and the top slightly above a bud.

Length of Cuttings.—The length of stem cuttings depends on the plant that is to be propagated. Carnation and chrysanthemum cuttings are made quite short, three to four inches long. Geranium cuttings are made anywhere from three inches long by some propagators to possibly five inches by others, depending on the supply of stock plants and the desire to hurry along salable plants.

Where the effort is to produce the greatest possible number of cuttings from the stock plants, cuttings are sometimes made with only one bud.

Cuttings to be started in the open ground should be made at least six inches long.

Temperature.—A low-air temperature is important in growing cuttings of some plants, holding the stem growth in check until

roots are well developed. For most cuttings a soil temperature of 65 degrees F. should be maintained. This is observed by a thermometer sunk about halfway in the propagating bed.

The temperature in the house should be about 50 degrees, so most propagating can be done to advantage before and after hot weather when it may be difficult to keep down the temperature. Some plants propagate well in warm weather, by keeping the house well shaded by means of whitewash on the glass and lath or canvas shades, and sprinkling the walks inside to keep the temperature down.

Bottom heat encourages the rooting of cuttings, so the soil is kept warmer than the air above by boxing-in the heating pipes under the propagating bench. Doors are made which may be opened to let out the heat and regulate the temperature in the propagating bench. The bench should be provided with drainage holes to let off any surplus water. A moderately warm and moist atmosphere favors the development of roots on cuttings. Cuttings of different plants may require somewhat different treatment.

Only a little of the leaf should be left on the cuttings to make food, removing as much of the foliage as necessary to reduce transpiration, making the lower cut just below a node where the cambium supply is greatest, keeping the soil moist and the atmosphere humid.

Transpiration must be reduced as much as possible until roots are formed. Water can only be taken up in a very limited way by the cuttings, until the roots have grown. The air in the propagating house must be kept moist and the plants well shaded from the sun. Some plants such as the willow and privet are easily rooted. Cuttings inserted in a shaded place in the open ground and kept wet will soon root.

Cold Frames.—Some cuttings are successfully started in cold frames. The cold frame is also useful for hardening off young plants from the greenhouse propagating bench. In large establishments a separate greenhouse is provided for propagating.

Propagating Bed.—In making the propagating bed, it is well to spread a thin layer of sphagnum moss or peat moss over the bottom of the bench, covering this with about four inches of sharp sand, leveling and packing it well before inserting the cuttings. Just before inserting the cuttings pound the sand down level and hard with a brick and firm the sand solidly around each cutting.

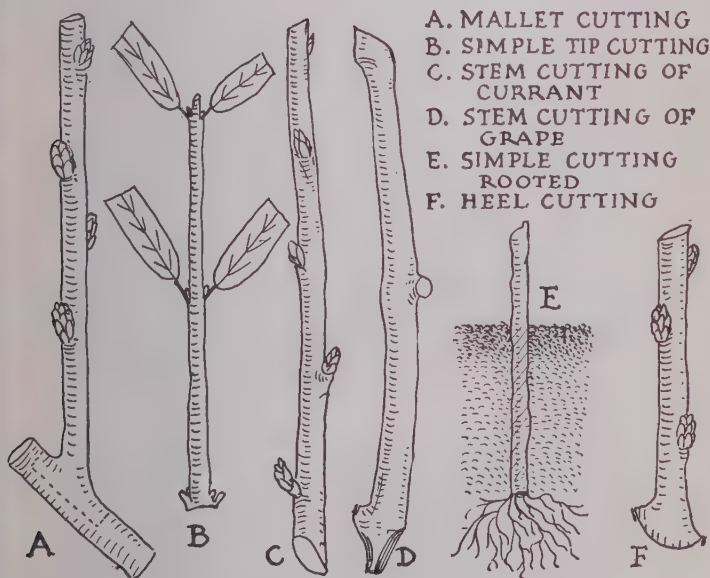
Best Sand to Use.—Sand from the borders of fresh-water lakes or streams is best for the propagating bench. It should be free from organic matter. Fresh sand should be used for each batch of cuttings or it should be sterilized to keep down fungous trouble.

TYPES OF CUTTINGS

Types of Cuttings.—Plant propagators have different names for different types of cuttings. Those most generally used are, single-eye cuttings, heel cuttings, simple cuttings, root cuttings, soft-wood cuttings, hard-wood cuttings, tip cuttings, trunch-eons, mallet cuttings and nurse-root cuttings.

Single-Eye Cuttings.—Cuttings of soft plants, such as geraniums or of the soft, present season's growth of hardwooded plants such as roses, mulberries or quinces, etc., as soon as

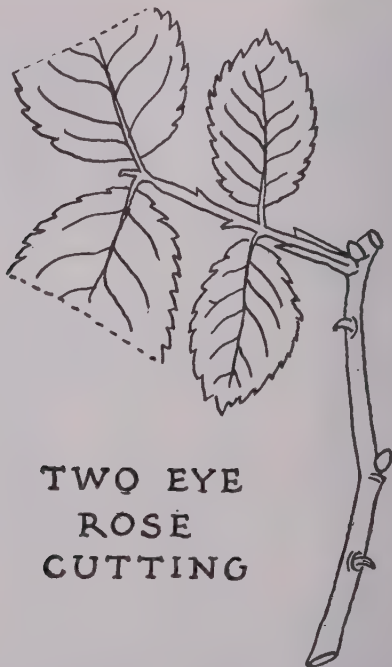
made, are placed in a propagating bench, in a glass house. It is the method used where the wood is scarce on new varieties or rare plants. A single node is used, usually having but one bud or "eye."



DIFFERENT TYPES OF CUTTINGS

A propagating house of glass is indispensable to a grower doing a good sized business. The benches contain clean sand, free from organic matter. Some cuttings root well in imported granulated peat moss, in place of sand. If the cuttings are made of dormant wood, they are callused, in a callusing bed and afterward placed in the propagating bench.

Heel Cuttings.—Cuttings from some plants will root better if a part of the branch from which the cutting is taken is removed with it. This additional piece at the base is called a “heel.” Not many plants require cuttings with a heel to root readily.

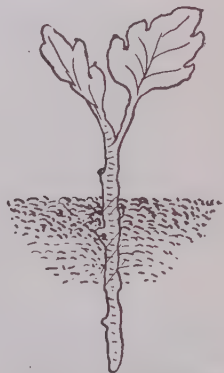


Simple cuttings are usually used in outdoor propagating of grapes and other plants, from one-year-old dormant wood. Citrus fruits and olives may be multiplied in this manner or from semi-dormant wood. In speaking of cuttings, simple cuttings are always meant, unless otherwise specified.

Root Cuttings.—Some hardy plants naturally sucker from the roots. These with others may be propagated from root cuttings. Select roots of fair size, say as large around as a lead pencil and cut into pieces three inches long, as soon as growth has ceased in the autumn. These are stratified by packing in layers in boxes of damp sand and stored in a cool, damp cellar, being careful to keep the sand damp.



**ROOTED CHRYSANTHEMUM
CUTTING**



**CHRYSANTHEMUM
CUTTING**

Examine the boxes frequently, and toward spring any that do not show signs of starting should be given more heat. Those that have formed buds and rootlets may be planted in the open ground. Some tender plants will not start until placed in the propagating bench; these, however, may better be made from stem cuttings.

Root cuttings should be planted shallowly, in a well prepared bed, firming the soil well about them. Shading and watering may be necessary.

Most trees can be rooted from cuttings made from the branch or from the roots. Root cuttings of budded or grafted trees will produce trees of the kind of root on which these trees are united.

Root cuttings are made from roots about a quarter of an inch in diameter, cut eight or nine inches long in autumn or spring, and callused in the same way as hardwood cuttings, in a calusing bed. When callused they are set out in rows.

Roots on cuttings form on the end nearest the root of the parent plant and the stems appear on the other end, the new plant assuming exactly the same position it held on the parent plant. This is true of stem and root cuttings. This is called polarity.

On stem cuttings the root forms at the bottom and stems at the top.

On root cuttings the top end will form stems and the bottom, roots. Root cuttings should be cut so that the planters can tell at a glance which is top and which is bottom.

Soft-wood and hard-wood cuttings are so called according to the wood from which they are made.

Soft-wood cuttings are taken from twigs of the present season, that are in active growth, and contain little reserve plant food. They must be promptly supplied with moisture and food and favorable conditions of growth. Soft-wood cuttings are described under Single Eye Cuttings. Geraniums, coleus and similar florists' plants, including the many hardy perennial plants, such as chrysanthemums, pansies, etc., which are classed by florists as "soft" plants.

Hard-wood cuttings, also called dormant cuttings are taken from wood that has wholly completed the year's growth or nearly so. They are cuttings of the small twigs of apples, pears,

and peaches, which require treatment in a callusing bed before they will root.

Dormant cuttings are inactive and growth in them starts slowly. It requires time for the cuttings to callus, before roots can be formed and for the cuttings to get into condition for growth before they are started, into active growth.

Dormant cuttings are made in the autumn or early winter, tied in bundles, labeled and placed in a bed where they may callus.

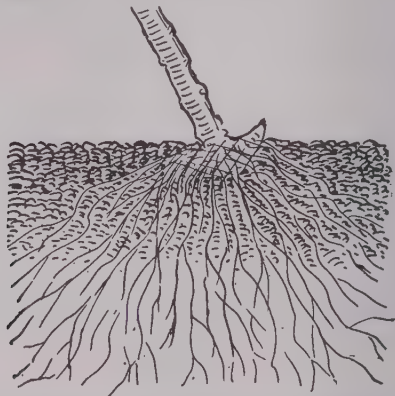
The callusing bed may be of sand where the temperature does not go above fifty degrees. The aim of propagators is to keep the temperature as nearly as possible around thirty-two degrees without permitting it to go lower, until after the middle of winter, after which time it is raised only very gradually until spring.

It is the cambium that spreads over the cut end of the cuttings and from this the roots start. Sometimes, but not generally, the roots develop from the nodes or buds, or even from the internodes.

Sometimes the callusing bed is made in the open ground, as is common in the South. A well drained site is selected where sandy soil may be had. The cuttings are made early and leaves remaining are stripped off. The cuttings labeled and tied and the bundles buried with the small ends down, the upper ends about three inches below the surface. The warmer surface soil hastens callusing.

After several weeks the cuttings are taken up and planted in nursery rows. If to be left for spring planting, the bundles are taken up, after a few weeks, and buried by laying them flat, sufficiently covered to prevent freezing.

Tip cuttings is one method of propagating plants such as the oleander, a plant popular years ago. It is the method largely used for olives. Cuttings are about three inches long from the tips of the branches. The bottom is cut below a bud and at once placed in a propagating bed under glass.

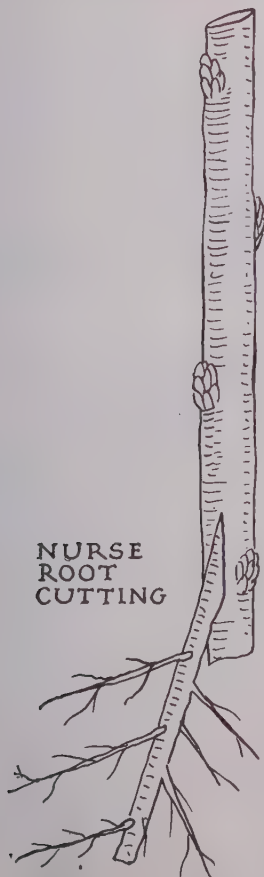


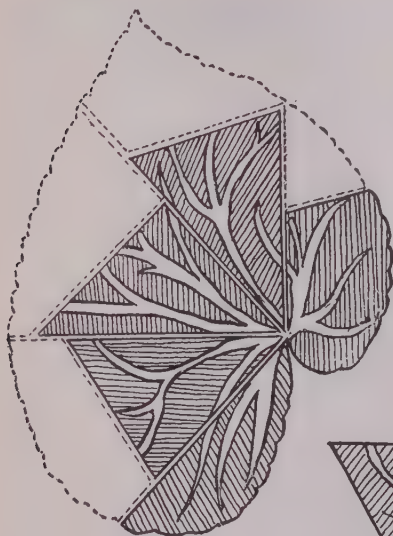
**TIP OF BLACK-RASPBERRY
ROOTED IN SOIL**

Truncheons are rarely used in this country. The small branches are saved at pruning time, and split or quartered according to size, placed in a propagating bed, bark side up, in the spring. The buds develop roots and branches. When the plants are large enough, the truncheon is dug and the plants separated.

Mallet cuttings are really a form of heel cutting. The branch is first cut from the tree or plant and the cutting then made partially with a saw, in large limbs, at each end of the mallet, the bottom cut is made with a chisel or knife. It is a form of heel cutting with a heavy heel.

Nurse root cuttings are simple cuttings on the bottom of which a piece of root is grafted which develops plants quicker





REX BEGONIA LEAF
CUTTING. EACH
PORTION HAS A
PIECE OF LARGE
VEIN. THE ROOTS
FORM AT THE BASE
OF THE VEIN

ROOTED
LEAF CUTTING



than simple cuttings. Some fruits stand local conditions better when grown on their own roots and if cuttings do not root readily, this has been found a very satisfactory method of propagation.



OLIVES PROPAGATED BY TRUNCHEONS

A SYSTEM RARELY USED IN AMERICA

Leaf Cuttings.—Cuttings can be made from the leaves of some plants, such as Rex begonias. A section of the leaf two and a half inches long and an inch or so wide, containing a rib running up and down in the cut section, will root if inserted in the propagating bed, or the leaves will take root where the ribs are held down to the soil. Gloxinia, peperomia, sansveria and other thick leaved plants may be propagated by leaf cuttings.



Chapter VIII

SEASON FOR MAKING CUTTINGS

Grape cuttings are generally made when the vines are pruned, after the foliage has dropped and before the flow of sap starts in the spring. One year, matured wood is selected and cuttings about eighteen inches long are made. The base is cut immediately below a node, the upper end just above a node. As soon as the leaves drop in the autumn and before the ground freezes, the cuttings may be made and set out in rows in the open ground, in deeply dug and well fined beds. Trenches can be made and the cuttings set in place, three or four inches apart, deep enough so only the top appears above ground. The soil is drawn about them and carefully firmed about the cuttings from the very bottom to the top of the trench. Or the cuttings can be set by making holes with a crowbar, reinserting the crowbar at the side of the cutting and working the soil toward and about it firmly.

If the cuttings are made in the winter, they are callused in the cellar, and those that have been callused are planted in the open, in the spring.

Where European varieties of grapes can be grown, these are propagated by grafting on varieties resistant to phylloxera. The cuttings are grafted on some native American variety, before the cuttings are put in the callusing bed.

The buds are carefully cut off below the graft, so that only the sprout will start, from the European variety. Skillfully

done, the grafted cuttings need no tying. A bud, or two, are left at the very bottom of the cutting from which roots develop and the cuttings placed in a callusing bed. By spring both the union and the cutting bases will be callused and ready for planting outside.

Autumn Cuttings Outside.—Cuttings of the stems of currants, raspberries and other hardy plants and root cuttings of blackberries may be made when the wood matures and planted in well drained soil in the open ground. These are called dormant stem cuttings. Mulch with straw or coarse litter just before freezing weather and shade them in the early spring.

Cuttings of Evergreens.—Some evergreens are propagated by cuttings made in the autumn. The cuttings are taken from the stems, and are made short and placed in cold frames. When cold weather arrives the frames are covered with sash and if needed, the sash are covered with straw mats, old carpets or other convenient protection. The cuttings will be well callused by spring.

Cuttings of evergreens are sometimes made in winter and placed in flats or small pots and set under the benches of a cool greenhouse.

Some evergreens root well from simple cuttings. For slower rooting cuttings, heel orallet cuttings are used of well ripened wood.

Cuttings are sometimes made in the early summer. Shading is necessary in warm, sunny weather and careful watering.

Some growers make evergreen cuttings and root them in the propagating bench in the greenhouse in late autumn or winter and grow them on in pots until spring, when they are set out in nursery rows.

Spruce and pine are usually grown from seed.

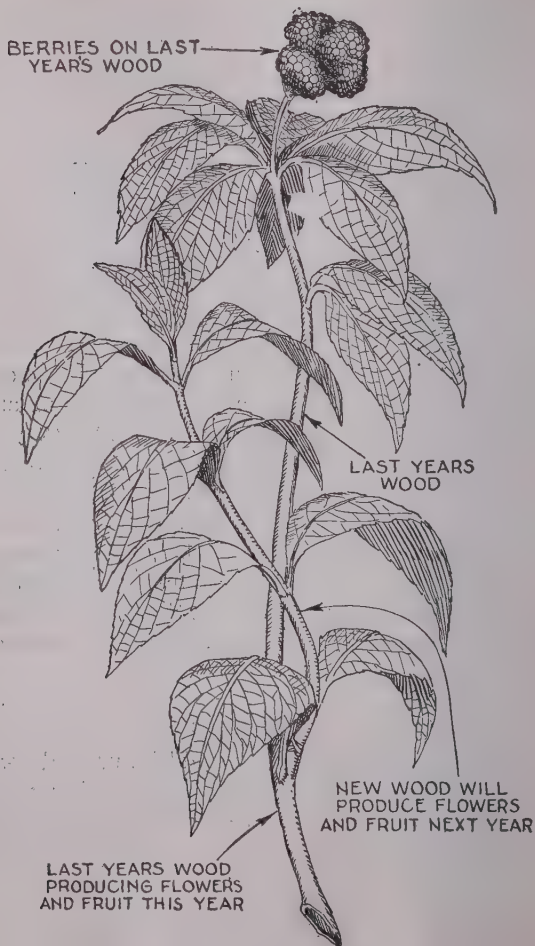
Shrubs from Summer Cuttings.—Quite a variety of shrubs and trees can be propagated from cuttings of soft wood or partially ripened wood, taken in June and July, in the latitude of New York. Other localities will vary according to the seasons.

These cuttings may be placed in flats, having at least four inches of sharp sand in them, placed in the greenhouse. The glass will require a coating of shading or glass over the cuttings may be shaded by tacking light cloth over the sash bars, inside the house. The cloth hung on brass rings, strung on copper wire will permit moving so as to supply light on dull days and early and late in the day. The propagating house is the best place, where there is one. Spray the cuttings every morning and do not allow the sand to become dry. It is always important in setting cuttings to firm the soil well about them. Unless this is done failure will result. The sand must be kept moist from the time the cuttings go in, until they are well rooted. When rooted, put in flats in good soil and, in proper season, set under a slat frame house or in coldframes covered with slat shades, raised a little above the frames. Keep moist and give winter protection of dried lawn clippings, straw or marsh hay. Transplant to the open ground the following spring.

Cuttings of some shrubs will root at this time when placed in good soil, well drained, in a shaded location in the open ground and kept moist.

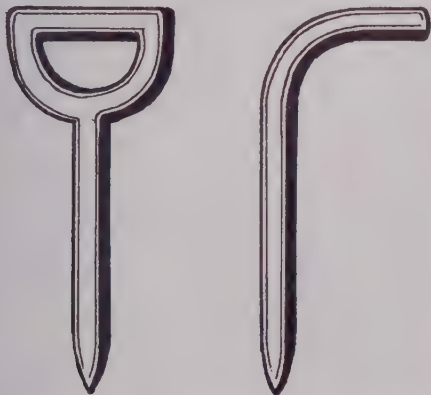
Coldframes.—If coldframes are used for starting the cuttings, about a foot of fresh horse manure will be needed for bottom heat. Over this spread six inches of sand. Cover the frame with sash and have a cover of lath or muslin, three feet above the frame for shade.

Shrubs that may be propagated as above, are: *Hydrangea* otaksa, *hydrangea paniculata*, lilacs, *forsythia*, *kerria*, *cornus*,



barberry, weigelia, calycanthus, deutzia, honeysuckle, privet and other shrubs. The batch of cuttings can be hardened off and wintered in coldframes.

DIBBERS OR DIBBLES



Planting Cuttings.—In setting soft wooded cuttings (cuttings from wood of the present season's growth), as is usual with geraniums, the base is set down far enough in the propagating bed to hold the cuttings firmly in place. Hard wood cuttings should be set so the bud at the top of the cutting is about on a level with the surface or slightly above it.

Cuttings from green growth are usually made with a leaf or two at the top of the cutting. A small leaf surface is desirable



BRUSH SCREEN FOR SHADING PLANTS IN THE OPEN GROUND

and in some cases, as with geraniums, only one or two leaves should remain and these may have the upper half of the leaf cut off with a sharp knife. The leaf should not be permitted to wilt, therefore the cuttings should be sprinkled as soon as set and they should be set soon after they are made.

Damping off, which causes cuttings to rot at the base must be guarded against. It is caused by over watering, too much heat, decomposing material in the soil or not enough air or light. Cuttings that damp off should be immediately removed and the cause corrected.

Green cuttings should be potted in small pots, as soon as the roots form and treated the same as full grown plants. Some propagators insert cuttings of easily rooted plants like geraniums, in small pots, which saves one shift. When the roots fill the pot, the plants are shifted into a larger size.

Cuttings of herbaceous plants root readily from the new growth. An old test to determine when the wood is suitable for making cuttings is to bend a shoot so its doubled surface will be parallel. When pressed together, if the stem breaks with a snap, it will root promptly. An experienced propagator will instinctively know what wood to use.

Cuttings can be rooted by amateurs in pots of light soil, set in a warm, light place, out of the direct rays of the sun, such as a north window, until the roots are formed.

Cuttings of woody plants are made from harder growths than used from herbaceous plants.

The cuttings should be taken from half mature wood, and two to three nodes in length, cutting below a node. These cuttings are rooted in summer in coldframes, but bottom heat hastens root formation and saves time.

*Chapter IX***GRAFTING**

Grafting is placing together two portions of plants, in such a manner that the two portions will unite and become one.

Only plants that have a cambium ring can be grafted. The cambium layer is a thin layer, between the bark and the wood. When a section of cambium of a plant is applied to another closely related plant, the two portions will unite under proper conditions. The union can best be made when the plants are in vigorous growth, which is usually in the spring.

The contact of the cambium in both parts—the stock and the cion—should be close and the parts should be cut carefully with a very sharp knife.

Reasons for Grafting.—There are several objects in grafting; to save trees that have been girdled by animals, or otherwise; to change a plant of an undesirable variety with a good root and stem, into one of a more desirable variety and bring it into flowering or fruiting quickly; to multiply plants that cannot be multiplied readily from seeds; to change the character of trees; to dwarf them; to put a weeping head or a bushy head on an upright growing variety as in the catalpa bungeii; also to replace damaged branches.

Different varieties of the same species may be successfully grafted such as one variety of a rose on another and so with apples, pears, peaches, plums, etc.

Different species of the same genus sometimes may be united by grafting, peaches may be grafted on to plums, pears with quince. Only trial will tell what plants will unite. Peaches and apricots do not graft well, but both graft on the plum. Pears graft on the quince but the quince will not unite readily when worked on the pear.

Species and Genus.—As these terms have been used in the preceding paragraphs it is well to fully understand their meaning.

Maples, oaks and apple trees are different **species**.

Plants that closely resemble each other, such as different varieties of apples—Baldwins, Northern Spys, Greenings, etc., as a group are spoken of as a genus.

The maples, Norway maple, sugar maple and white maple, together are classed as a genus, the plural of this Latin word is genera.

Cions are used in both root and stem grafting. Cions are usually made in the late autumn of a preceding year, taken from dormant wood of the previous year's growth, containing one or more well-formed, healthy and mature leaf buds. They can also be made during mild winter weather or in the early spring. These are packed in damp sand or damp sphagnum moss and stored in a cool cellar until needed. They must not be kept so moist as to form a callus or to cause the buds to swell and they must not be allowed to dry out sufficiently to cause shriveling.

Making the Joint.—The bottom end of the cion is joined to the top end of the stock so that the cambium layers come together over as much surface as possible. The joint is then tied with cloth, cord or raffia, to hold the parts firmly in place; and then to prevent evaporation and to protect the wound until thoroughly healed, the joint is covered with grafting wax.

Influence of Soil and Stock.—Careful observers who have bought fruit of the same kind, such for example as Baldwin apples or Fameuse from growers in different sections, or who have noticed the marked difference in fruit of the same kind at exhibitions, may have wondered why this variation. Seven or eight apples of the same kind from different orchards, varying decidedly in color and flavor. This may have been due in part to soil and climatic conditions. It may also be partially on account of the stock or cions used. No two things in nature are exactly alike. It is the encouraging of these variations, however slight, that has given us many valuable plants.

The kind of stock used in budding or grafting, produces a decided influence on the cion. That is what produces our dwarf peaches, working them on plum stock and dwarf pears by working them on quince stock. The slow growing stocks reduce the size of the cion worked on them. The reverse is equally true. The quince worked on the pear will be increased in size. Cions of vigorous trees tend to increase the root growth of the stock and some unions produce larger growth of root and stem than either would make naturally, and by some combinations one or the other may make a smaller growth than naturally. Peaches on Myrobalan stock have a large root growth. Almonds on peaches are larger than either grown naturally. The fruiting age is also affected by this influence. Dwarf pears will fruit from one to three years sooner than standard trees, though

dwarf trees do not live as long as standards. Peaches on plums bloom late. Plums on peaches bloom early. No doubt the color and flavor of fruit can be somewhat influenced by grafting and if the operation were carried on over a very long period, the result might be very marked. Poor keeping, but good flavored apples will keep better when worked on stock of good keeping varieties. This is a subject of interest to those inclined to experiment and one that we will know more about when more study has been devoted to it.

Dwarf Fruit Trees.—Dwarf fruit trees are desirable because, being small, a greater variety of fruit may be grown in a small space. The trees remain dwarf without any special care.

Plants may be dwarfed in several different ways, by growing them in a small space, such as pots which will not permit full expansion of roots, by careful disbudding or pruning, and in other ways.

Dwarf fruit trees offered by nurserymen are produced by budding or grafting the variety on slow growing root stock.

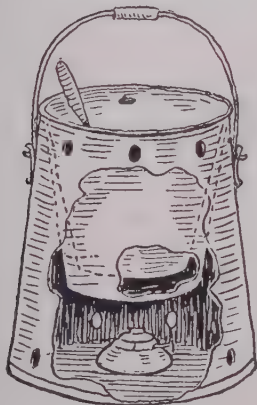
Care should be exercised in planting not to set the trees so deeply that the cion may possibly develop roots above the stock, as then the tree may become standard. If any roots develop from the cion, they should promptly be removed. Dwarf trees on some stock may require annual heading back to keep them well dwarfed.

Grafting Wax.—There are many recipes for grafting wax. The rosin and beeswax waxes are best for outdoor work.

Into a kettle place one part by weight of tallow, two parts of beeswax, four parts of rosin. When completely melted, pour

into a tub or pail of cold water, then work it with the hands, which should be greased, until it develops a grain and becomes the color of light-colored manila paper. This is the New York State Agricultural College formula.

Old propagators use long narrow strips of cotton cloth which have been soaked in melted grafting wax. Cotton cloth is torn into strips of the desired width and wound into balls. The balls are placed in the kettle of melted grafting wax until they



HEATING POT
FOR GRAFTING
WAX

are thoroughly saturated, when they are removed and set aside to drain and dry. The tape is wound around the graft and tied with a piece of string. It is handled about like tire tape.

Waxed string for root grafting is made by placing balls of No. 18 knitting cotton in a kettle of melted grafting wax, until they are thoroughly saturated. Drain and dry. The string sticks without tying.

A hard wax for use in warm weather: Four pounds rosin, one pound beeswax, half-a-pint to a pint of raw linseed oil free from cottonseed oil. Melt all together gradually. When melted, turn into water and pull. Lumps in wax indicate improper handling. If too lumpy, melt and pull again. Unless pure linseed oil can be obtained it is better to use tallow.

Wax to be applied from a Grafting Pot.—Six pounds of crushed rosin, one pound finely cut beeswax, one pint pure linseed oil. Melt the rosin and beeswax together, then stir in the linseed oil.

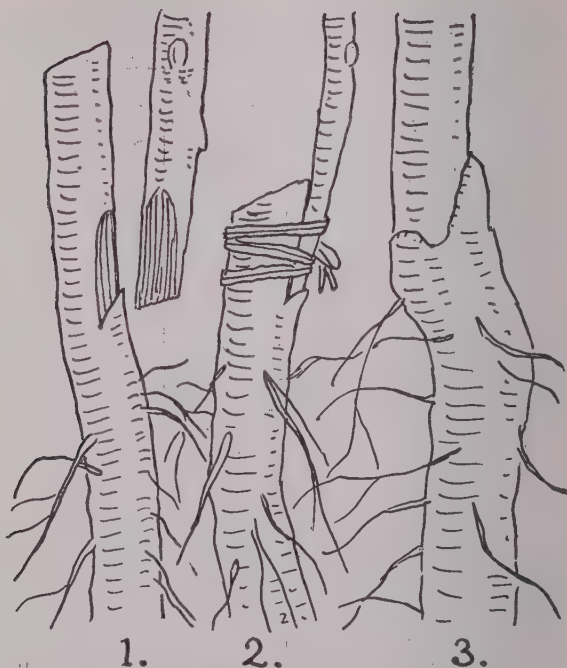
Liquid wax is a thick paste. It is used in winter when rosin wax cannot be applied, for bridge grafts and covering wounds. One pound white rosin, one ounce beef tallow, one tablespoonful turpentine, five ounces alcohol. Melt slowly. When hot add beef tallow. Remove from the fire and add slowly, constantly stirring, the turpentine and alcohol. Keep in closed bottles. Use a brush in applying.

A pot for heating grafting wax is suggested by the New York State Experiment Station, consisting of a can which holds a glue pot, with water in the bottom and wax in the top and a lamp to heat the water below.

Propagating Table

1—Indicates the usual method. 2—This method may be used.
3—This method sometimes used. O—Impractical.

	Grafting	Budding	Cuttings	Layering
Almonds.....	2	1	0	0
Apples.....	1	2	3	0
Apricots.....	2	1	0	0
Avocados.....	2	1	3	0
Cherries.....	2	1	0	0
Citrus Fruits.....	2	1	2	0
Dates.....	0	0	1	0
Figs.....	2	2	1	3
Grapes.....	2	0	1	3
Kumquats.....	1	2	2	0
Loquats.....	2	1	2	0
Mangoes.....	2	1	2	0
Mulberries.....	2	2	1	0
Olives.....	2	2	1	0
Peaches.....	2	1	0	0
Pears.....	2	2	0	0
Pecans.....	2	1	3	0
Persimmons.....	2	1	0	0
Plums.....	2	1	0	0
Prunes.....	2	1	0	0
Quinces.....	2	2	1	0
Walnuts.....	2	2	0	0



VENEER GRAFTING

1. STOCK AND CION

2. GRAFT IN PLACE

3. UNION COMPLETED

Chapter X

GRAFTING METHODS

Grafting is divided into the following major divisions: (1) bud-grafting or budding; (2) cion-grafting or grafting proper. Each of these divisions is again divided into many sub-divisions.

In budding, for example, there is grafting or budding with shield buds, T-budding (which is the ordinary method), flute grafting, etc.

Cion grafting or grafting proper includes: whip grafting, veneer grafting, cleft grafting, tongue grafting, crown grafting, saddle grafting, root grafting, approach or inarching, etc.

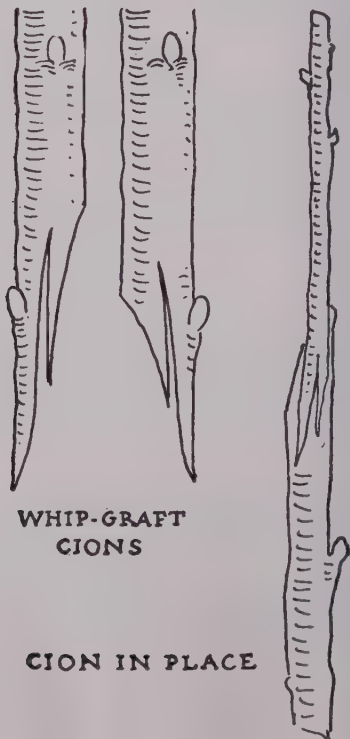
Only whip grafting, veneer grafting and cleft-grafting are much practiced.

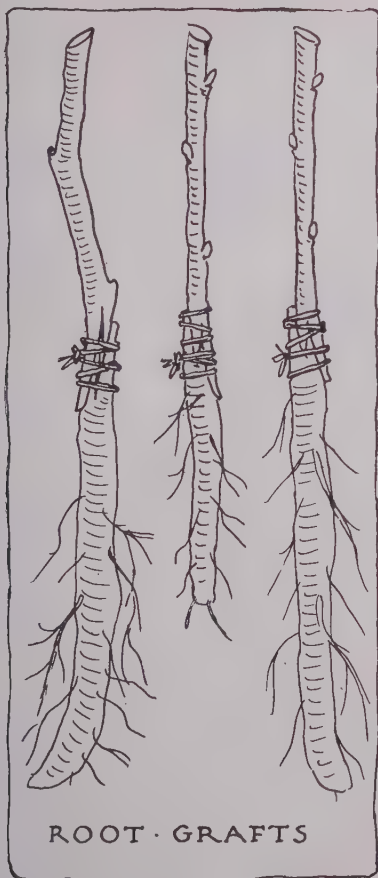
WHIP GRAFTING

Whip Grafting.—There are various forms of whip-grafting. In side whip-grafting, the cion is placed on the side of a stock instead of on the end of it. The tongues in cion and stock are cut the same as in the method already explained.

Whip or tongue grafting, is used on small stocks, one or two years old. Cion and stock are cut across diagonally for one or

two inches. A vertical cleft is then made in each and the two joined by inserting the tongue of the cion into the cleft of the stock. The parts are firmly tied with raffia wound around them five or six times, and the graft protected by applying wax over the bandage. Strips of cloth soaked in grafting wax are also used for holding the parts in position.





ROOT GRAFTING

Root grafting, especially on fruit stocks, is done in winter. The one or two year old stocks are dug and stored in autumn.



In January or February the work of grafting is begun. Only pieces of roots are ordinarily used. For nursery stock on fruit trees, the whole root is used, making the graft at the crown to hasten developments of strong, young trees.

In piece root grafting a piece of root three to four inches long is used, the parts being held in place by waxed string. The string is strong enough to hold, but can easily be broken by hand. No. 18 knitting cotton, waxed as suggested previously, is used for this purpose.

The grafted plants are packed away in damp sand, moss or sawdust in a cool cellar until spring, when the union will be well callused.

Skillful propagators sometimes pack the grafted plants away without tying the grafts together. They are stored in a cellar where the temperature does not go above 40 degrees nor below 32. They callus sufficiently so that if carefully handled, they may be safely planted. The advantage of this system is that it does away with strings that do not decay when growth starts, and are likely to strangle the graft. Waxed cotton, if wound too many times about the union, may last too long and cause the loss of plants.

The cion is generally taken with about three buds and the root about the same length.

Root Hardiness.—To be certain of the hardiness of the roots, where the climate is severe, they should be obtained from the same plant as the cion, certainly from equally hardy plants. In the Northwestern states, a cion nearly a foot long is used and it is set in the soil up to the top bud. The root portion only serves as a temporary support until roots are formed from the cion itself. The old root dies away or is removed when the trees are sold. This is really trees on "own roots," a method

in plants which has decided advantages, except in comparatively few cases.

Root grafting is done at a slack season in the nursery when the help is available. Another advantage of root grafting is that many trees are made from one stock.

Rooted cuttings are sometimes used as stocks instead of seedlings, when a variety that grows readily from cuttings unites well with a variety from which cuttings do not root well.

There is little difference between a root-grafted or budded fruit tree in actual results, except the buyer's preference. In the East budded stock is preferred. In the Central States, most of the stock is root-grafted.

The stocks for root grafting are small trees grown one or two years from seed. These are dug in the autumn and stored in a cool cellar packed in damp moss or sawdust. At grafting time the roots are washed and trimmed, cutting off the larger branch roots. The stem is cut off at the crown with a diagonal cut about an inch long. A tongue is formed on each, by splitting the wood a short distance. The root is then cut off about three inches down, if the remaining portion is thick enough, and shaped as was the first piece. Thus several pieces are frequently obtained from a single root. Some propagators make only one stock from a root.

VDNEER GRAFTING

Veneer-grafting is sometimes used on rare ornamental stock. An incision is made on the stock, through the bark and about an inch long, the piece of cut bark being cut off with a downward, sloping cut, leaving a lip. The base of the cion is cut off to match the cut in the stock. The lip on the stock covers the bottom of the cion which is tied to the stock with raffia. Waxing the wound is not necessary when the operation is performed

as it usually is under glass, but waxing is helpful. Outside of the greenhouse, waxing is necessary. The cion is generally applied close to the surface and the stock is not headed back until the cion is completely united.

Either dormant or growing cions may be used by this method. Plants that are growing are placed in a frame in the house and almost completely covered with damp sphagnum moss and the house kept moist and cool until the parts have united. Japanese maples are propagated in this way. One advantage of this system is that failure does not injure the stock, which otherwise might be lost.



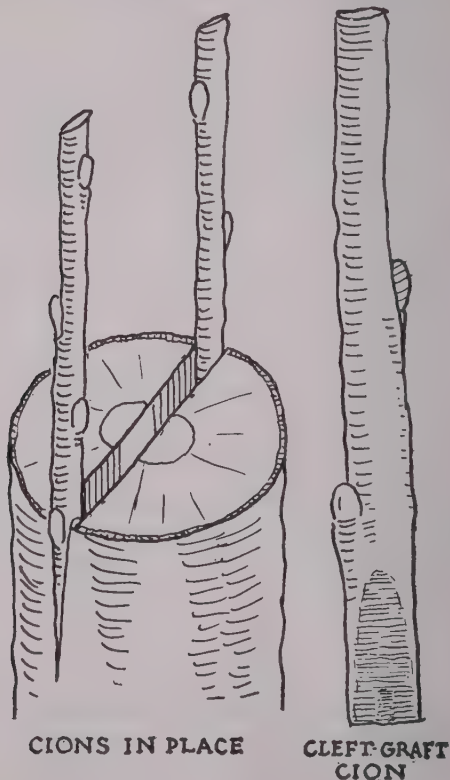
CLEFT-GRAFTING KNIFE

CLEFT GRAFTING

Cleft grafting is the method used when the stock is much larger than the cion. It is the method used for top-grafting old trees. The end of the stock is split through the center with a grafting chisel and two cions are used, one on each side, to hasten the healing of the stub.

This form of grafting is heroic treatment and should be used as little as possible. The cion should be cut with three buds, the lowest just above the wedge. The sides of the cion should be cut even and smooth with one cut of a sharp knife, the outer edge being cut thicker than the inner so the stock will hold it tightly. The shoots from which the cions are made should be taken in the late autumn and stored, or cut early in the spring. The stock should be cut square with a good sharp, fine toothed saw and split down about two inches. The split is

then opened with the wedge on the end of the grafting knife which holds it in position so the cions can be inserted.



The cions are inserted on each side of the cut in the stub, so the cambium layer of stock and cion come together nicely at the outer edge of the stub, the lower bud of the cion just above the

stub, fitting tightly. If the tops of the cions point outward just a little, contact of the cambium layers will be more likely to be made. Unless there is sufficient pressure in the stub to hold the cions firmly in place it should be tightly tied. Coat all the wounded surfaces with grafting wax.

Usually only branches are grafted in this manner which do not exceed two inches in diameter, and smaller are better.

Where a whole tree is to be treated, about half the top is cut away just previous to grafting. Some branches are left to encourage growth. The most horizontal branches are used for grafting. If both cions grow, the weaker is pruned off and all shoots from the stock are kept from growing.

Gradually, as the grafts develop, the branches left on the stock are cut off so only the grafted stock remains.

Cleft grafts are waxed with a brush, the wax melted in a glue pot. When the weather is warm so the wax can be handled, it is applied by hand, the hands being greased to keep the wax from sticking.

Apply the wax to the sides of the graft first. Then cover the top of the stub so water will be completely shed and all the cut bark fully covered. Apply a little wax to the top of the cions also if they are cut.

Expert grafters make as high as six or seven hundred cleft grafts a day.

In grafting old trees the aim should be to have the new top conform to the old shape. Many stubs should be set and in well trained trees all the principal branches should be grafted.

Cleft grafts should be covered every year with grafting wax or paint until the bark has completely grown over the wounds.

Before dressing tree wounds, they should be thoroughly cleaned. Cut and remove any broken bark and decayed wood. Leave no rough or ragged edges. It is advisable to disinfect the wound with corrosive sublimate, one ounce to seven gallons of water, or use bordeaux mixture.

Cleft grafting is sometimes used for grafting soft stocks such as cactus and it is common with peony roots in summer. The stock is fastened with fine wire. No wax is used as the union or graft is covered with earth. Dahlias and other plants may be grafted in the same way.

SPLICE, SADDLE AND BRIDGE GRAFTING

Splice grafting consists of simply cutting the two parts across diagonally, putting them together, fastening and waxing.

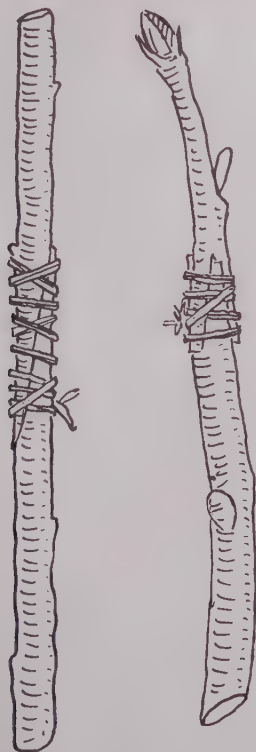
Saddle grafting consists of cutting the stock to a wedge-shaped point, cutting an inverted V or a slit in the cion and setting it over the stock, tying and waxing. This is the method used when a cion is cut with terminal bud.

Bridge grafting is used to prolong the life of trees that have been girdled by animals.

Girdled trees may sometimes be saved without grafting, if the exposed wood does not become dry and diseased. The rough edges of the bark should be carefully trimmed and the wound washed with bordeaux mixture, after which the entire surface should be covered with melted grafting wax and then bound up with cloth. Girdles on fruit trees ten inches wide, completely surrounding the tree, treated in this manner, have healed.

If the girdle has been exposed so long that the wood is dry or

the tree is a valuable one, bridge grafting had better be resorted to.



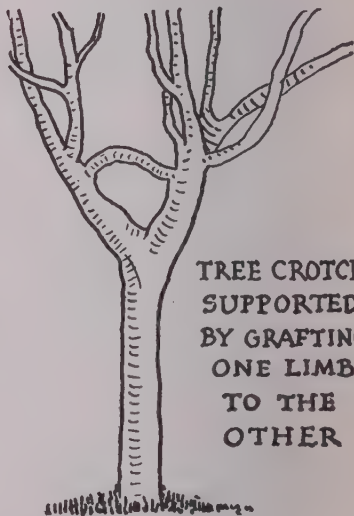
SPliced SADDLE
GRAFT GRAFT

Trim the edges of the wound and cut the cions an inch or two longer than the width of the girdle and sharpen both ends.

Insert one end under the bark at the bottom of the girdle and the other under the bark at the top, placing the cions closely together around the tree. The ends are tied so they will remain



**BRIDGE GRAFTING
TO SAVE GIRDLED
TREES**



**TREE CROTCH
SUPPORTED
BY GRAFTING
ONE LIMB
TO THE
OTHER**

in place and the ends of the cions and the exposed edges of the bark are covered with grafting wax. A small brad may be driven through the ends of the cions, into the tree to hold them in place. Care should be taken to see that the cions do not send out shoots from their buds.

Properly done and cared for to prevent damage by insects and disease, treated trees may be as strong as though they had not been injured. On the other hand some trees never fully recover.

HERBACEOUS GRAFTING

Herbaceous grafting is not in general use. Grafting which has been considered in previous pages has been of dormant cions and hard wooded stocks. Herbaceous plants may also be grafted. Tomatoes may be made to grow two or more varieties on the same plant and geraniums and begonias and other plants may be grafted. Select shoots for grafting that would make good cuttings. The union is carefully bound with raffia and the plants set in a propagating frame and kept close for several days. No wax is used.

INARCHING

Inarching or approach grafting is the grafting of branches while both parts are still attached to their own roots. When the parts have grown together, one may be severed from its roots. Limbs of trees are grafted in this manner. It is the best method of supporting crotches in trees that are likely to split. See Chapter 6.

DOUBLE GRAFTING

Double Working.—Grafting on a grafted tree or making one graft above another is called double grafting or double working.

Pears are grafted on quince stock to obtain dwarf trees. Some varieties do not unite readily with the quince, so a variety that unites readily is used first and on this graft a second variety is grafted. Both unions in double working are made close to the ground. The first cion is usually allowed to grow for a year, when it is cut back to an inch or two above the original stock and the second graft applied.



APPROACH GRAFTING

*Chapter XI***BUDDING**

Budding is employed in the propagation of fruit trees, roses and various other trees and plants. A single leaf-bud, bearing almost no wood, is used in this operation. It is inserted under the bark of the stock, in contact with the cambium layer. This is the method generally employed.

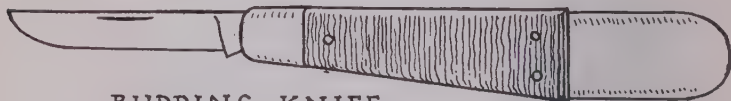
In flute budding, a piece of the bark, usually a small square, is entirely removed and the piece containing the bud made to fit the place in the stock where the bark was removed.

The same kinds of plants may be propagated by either budding or grafting. Some are reproduced as rapidly and as favorably one way as another. Others thrive best by one or the other methods. As a general rule, plants with thin bark, with freely flowing sap, are best propagated by grafting; if budded, the work should be done when the sap is not flowing freely, otherwise the bud is likely to be strangled.

Time for Budding.—Budding is usually done in the growing season, when the bark is readily separated from the wood; then the stocks are large enough to be worked and mature buds are obtainable. If budding is to be done in the early spring, as soon as the bark separates readily, dormant buds must be taken in winter and kept in a cool place until wanted for use.

In the North, budding is done from July to the middle of September, while in the South it begins in June, or earlier according to location.

Peaches are budded the same season the pits are planted. Apples and pears are not budded until two years after the seeds are sown. The plants are taken from the seed bed the second spring and transplanted into nursery rows where they grow and are budded as soon as large enough.



BUDDING KNIFE



CUTTING OF BUD

Some stocks are trimmed when taken from the seed bed and before transplanting part of the top is cut back, if needed, and if there is a tap root, that is cut back. Stocks less than three-eighths of an inch in diameter are difficult to bud.

Remove the leaves from the base of the stock by rubbing them off before budding. This may be done just before budding or the day previous, but not earlier than that. Cut off any branches that will interfere with budding.

Insert the bud as near the ground as possible, so the joint or union may be set below the surface when transplanted.

Buds set on the north side of the stock will give better results because they are shielded from the drying influence of the sun.

The buds are taken from the variety to be increased from strong, but well hardened branches of the present season's growth. The leaves are removed from the branch, leaving a part of each leaf stalk to enable the bud to be handled easily. The branch frequently bears many buds suitable for use. The end buds which are not fully developed are not used.

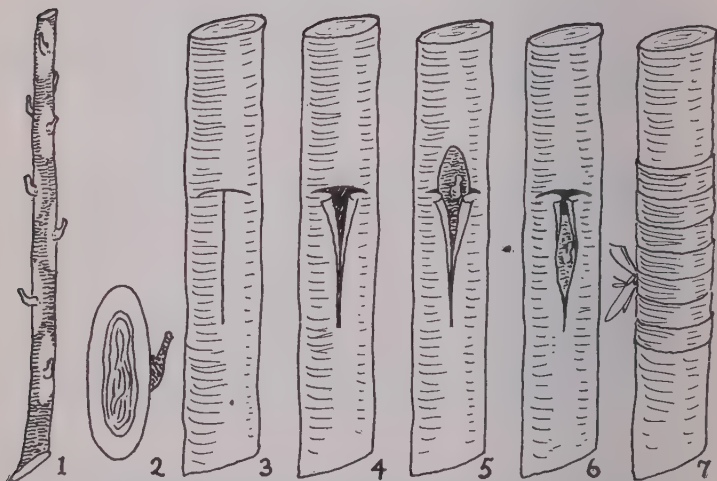
The buds are cut as wanted for use with a budding-knife, having a thin, sharp blade, with a curved cutting end. The curved portion of the blade is the part used for making the cut in the bark of the stock to receive the bud.

There are various styles of budding knives, some having a thin bone blade at the end, for lifting the bark of the stock when inserting the bud. This kind of a knife is also used for making cuttings of soft-wooded plants such as geraniums, begonias, fuchsias, etc.

The stick, as the branch is called, containing the buds is usually held with the bottom end up, the bud cut with about an inch of the bark, slicing down toward the thumb, much as some persons sharpen a lead pencil. The surface should be smooth and the bud piece not too thick.

Points to Remember.—The buds must be fresh and plump. Dried or shriveled buds will not grow. The growing points of the bud must not be injured.

Care must be exercised not to mix varieties by getting the buds mixed. Nurserymen who sell fruit trees are supposed to guarantee the variety sold to be true to name.



1. STICK OF BUDS 2. SHIELD BUD 3. CUT IN
BARK 4. BARK OPENED 5. INSERTING BUD
6. BUD INSERTED 7. BUD TIED AND OPERATION
COMPLETED

*Chapter XII***BUDDING METHODS**

Fruit Trees.—Peaches will grow three or four feet the same season from a bud and may be sold or transplanted the same year. Apples and other trees are not marketable until the second or third year.

Early summer budding is sometimes practiced on fruit tree stocks that are one or two years old. The shoots containing the buds are cut the previous winter and kept in damp sand or moss in a cool place where they will not swell; and late in the winter, if it is warm or in the early spring are put on ice in sand or moss, where they are kept from swelling until the stocks are ready to be budded.

In top working old trees by budding, the buds start the same season they are set, if the budding is done early in the season and develops sufficiently during summer so the new growth will be able to survive the winter.

Budding cannot be done easily in old and heavy bark. If old trees are to be top worked by budding instead of grafting, the best plan is to severely prune the old trees early in the previous season. This will give rise to many young shoots, in which the buds can easily be inserted.

SHIELD BUDDING

Shield-budding, so called from the shape of the piece containing the bud, is the system generally used in budding. The bud on the slice of bark removed with it resembles a shield.

The cuts in the bark of the stock to receive the bud are made by two light cuts, only just piercing the bark, one short cut lengthwise and the other at the top of this cut, across the stem, the two cuts forming a letter T. The vertical cut should be from an inch to an inch and a half long. The bark is loosened with the knife to permit the bud to be slipped down under the bark, the entire bud being covered with the bark of the stock. If any of the bud bark projects, cut it off. The bud should be tied with raffia as soon as inserted, being careful not to cover the bud itself.

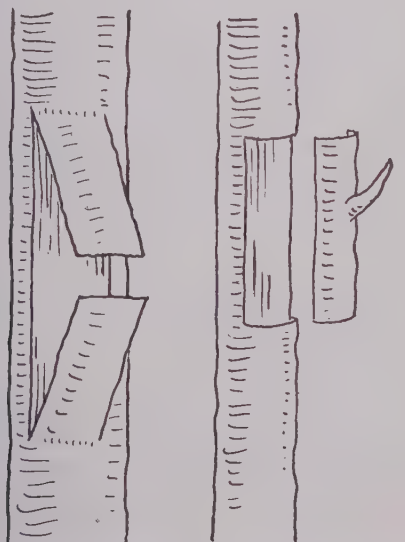
The bud will unite with the stock; then the bandage should be removed. This is done with a single cut of a sharp knife, cutting through all the warps of raffia. Any buds that have failed to unite should be rebudded.

The buds worked on in summer or autumn should remain dormant until the next spring. If they start they will likely be killed by winter weather. Buds that begin to grow in warm and wet seasons immediately after budding, should be headed back.

The following spring, the stock is cut off above the bud. This is accomplished by two cuttings. The first leaves the stem a few inches long, above the bud as soon as the stocks begin to grow. When the bud has developed a shoot an inch or two long the stock is cut off an inch or two above the bud and all sprouts are rubbed off the stock as fast as they appear.

FLUTE AND H BUDDING

Flute budding is quite similar to patch budding. A piece of bark nearly square is cut and removed from the stock and the bud piece is cut to fit the hole in the stock made by the piece of bark that has been removed. The bud is then tied and waxed.



H. BUDDING

FLUTE BUDDING

H Budding,—consists of making two perpendicular incisions in the stock, and making a horizontal incision connecting the two in the middle, thus forming a letter H. The flap above and below are raised, the bud inserted and then covered with the flaps of bark and tied in place and waxed.

The same idea, that of inserting a bud in a stock, can be performed in many different ways, all are modifications of the same process.

EARLY OR JUNE AND DORMANT BUDDING

Early or June Budding and Dormant Budding.—In early or June budding, growth of the bud is desired the first season. In late or dormant budding, the effort is to keep the bud dormant until the growing period, the next season. Early budding is only used where the growing season is long and where the young shoots will not be injured by early cold weather. The top of the plant is cut back somewhat, in early budding, as soon as the bud is set. The trees are gone over several times during the season and cut back as needed. When the new shoot is about two inches long, the top can be cut back close to the bud.

In dormant budding the cutting back is not done until the following season, when the trees are cut back slightly above the bud when growth starts.

Dormant buds make a rapid growth, producing trees from three to six or seven feet high the first growing season, on rapid-growing standard fruits. The slower growers will require two seasons' growth and some three to make salable trees.

Cultivating.—Budded stock should be cultivated frequently. Not much fertilizer should be used, very little nitrogen particularly, as this forces top growth, instead of desirable, solid, stocky growth.

Sprouting.—Heading back the seedlings causes sprouts to start on the seedlings. These should usually be allowed to

develop until the middle of summer, so as not to force rank growth from the bud. At that time the sprouts are removed from the stock, being careful not to remove the sprout from the bud.



BUNDLE OF 27 PLANTS OF RANERE RASPBERRY

Plants should be heeled in immediately on arrival if they cannot be set at once

Chapter XIII

TRANSPLANTING

Transplanting, briefly, is moving a plant from where it is growing—taking up the plant completely with its roots—and planting it in another location. Taking a plant from one pot and placing it in a pot of larger size is really transplanting, but is called repotting or shifting.



RASPBERRY PLANTS, GOOD FOR SETTING

Left: Ranere, red. Center: Columbian, purple. Right: Cumberland, black

Time for Transplanting.—Plants that live for more than one year are best transplanted during the season when they are dormant.

In mild climates transplanting is most successful at the beginning of the dormant period, providing this is at a season when there is sufficient moisture. In localities where the winters are severe and the ground is frozen for several months and where the autumns are dry, spring will likely be the most favorable season for transplanting.

In the North, apples, pears and quinces may be transplanted in the autumn, but the stone fruits, peaches, plums, cherries and apricots, are generally transplanted in the spring.

Many of the shade and ornamental trees are transplanted in the autumn, also shrubs and hybrid perpetual and hybrid tea roses.

Evergreen trees being always in foliage and being subject to little moisture at the roots through the winter and the foliage subject to drying winds, should not be moved until the buds begin to swell. August or September is the best time to transplant evergreens in New York State.

If the autumn has been dry, evergreens will stand the winter better if they have been watered well before the ground freezes.

Young tender plants, such as tomatoes, cabbage, asters, zinnias and the like, that are grown in the soft soil of a seed bed may be drawn from the moist soil by simply pulling them out, first watering well, but the more carefully they are handled the better.

Plants of this kind when transplanted or set in the open ground should, as far as possible, be set out after sundown or

immediately after a rain, when the soil is damp, or they should be immediately watered and protected from the sun. Transplanted on cloudy days the plants will suffer less than on bright days. Mulching is important in cases of drought.

In watering, water thoroughly and do not permit the roots to become dry.

Plants in leaf like asters may have the tops of the leaves cut back somewhat when transplanted. Plants in leaf should be shaded until the roots become active. That is why cloudy weather is good transplanting weather.

Trees and shrubs should be handled carefully, injuring the roots as little as possible. The more carefully they are handled the more quickly they recover from the shock of the operation.

In nurseries where rows of young trees are dug at one time, a horse drawn digging machine is used.

Moving Large Trees.—Large trees should be dug with as large a ball of earth as possible. If there are roots extending out for a long distance, these are uncovered and wrapped carefully, without breaking, around the ball of earth.

Sometimes very large trees are moved by digging a trench around the tree before the ground freezes. The trench is made far enough away from the trunk so that sufficient roots will be left within the ball of earth for the support of the tree. A hole of somewhat larger size than the ball of roots is dug for its reception at the place where the tree is to be located. When the ground is frozen, the tree is thrown over by means of a rope and tackle, block or a windlass. Planks are laid for the ball of earth holding the roots to skid on and the tree drawn to the hole, which has been prepared, and dropped in and righted by the ropes and tackle block.

Large trees are raised or lowered, when grading is necessary, in quite the same manner. Some large specimens such as magnolias cannot very well be successfully moved in freezing weather.

Label Wires on Trees.—Trees as received from a nursery frequently have labels wired on them. Before setting the trees, go over each one carefully and remove every label. Many fine lots of trees have been ruined, after making a good start, by careless or stupid workmen who left the labels on the trees. As the trees grow the wire cuts the trunk and checks the flow of sap. Sometimes the tree grows over the wire, but a weak spot results in the trunk and when pressure is brought to bear, by wind or otherwise, the tree is apt to break off at that point.

Trimming Before Righting.—Before righting the tree, the branches are trimmed back well, so the lessened root system will not have more work to perform than can be done to support the top growth.

Balled and Bailed Trees.—Large evergreen trees, when removed from the nursery, should be taken up with a good sized ball of earth, and this wrapped in burlap. The roots in the burlap may be planted without removing the burlap, as that will soon rot away. Take care that no wires or stout cords remain tied about the trunk of the tree to strangle it as it expands.

Exposed Roots.—The roots of plants should be carefully handled to avoid injury. They should be protected from freezing and from drying. Do not expose them to sun or wind and keep them damp or wet.

Puddling.—Nurserymen sometimes make a thick paste of earth and water. Tree roots are dipped in this to prevent their drying out. This should not be depended upon for distant shipments.

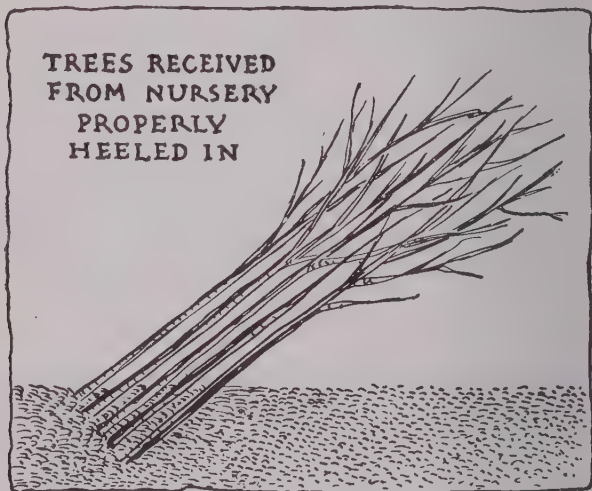
Bundling.—To economize space, nurserymen, in shipping trees, tie them in bundles. A sawbuck arrangement is made and the arms covered with a padding of old carpet, so the bark of the trees will not be injured. The trees are laid in the arms with the roots even at the end. The trunks are then drawn together with a stout strap and the trees tied in place with willow twigs or soft cord. The roots are then covered with damp moss, filling all the spaces between them, so all are completely covered. If only a few trees are to be shipped, these are tied up in bundles of straw, rushes or burlap. If to be shipped a great distance or if there are many trees, the bundles are boxed.

Unpacking Trees and Shrubs.—Unpack nursery stock or plants as soon as received and remove them from the box. Trees, if they cannot be planted at once, should be heeled in.

Heeling in consists of setting the plants close together in shallow trenches, immediately covering the roots with soil. If the soil is dry, water promptly.

Use of Dynamite in Planting.—Where the subsoil is compact or there is an impervious layer near the surface, dynamite may overcome these undesirable conditions. Dynamite has been used with good results in some tree planting. The dynamiting should be done several months before the planting is to be done, in order to let the soil settle back into place after the rupture caused by the blast. A satisfactory tree hole cannot be made under favorable conditions, as cheaply by dynamite as by shovel or spade and hand work.

Setting the Trees.—Trees, the roots of which have been puddled, should be washed before planting. Any broken roots should be cut off. Ragged, broken ends should be cut smooth.



The holes in which trees or shrubs are set should be large enough to permit the roots to spread out their full length. Do not plant the roots bunched together, but spread them out as nearly as possible in their natural position.

The trunk of the tree should be set just a trifle lower than before. The trunk will show the depth at which it was previously planted. Work the soil carefully in around the roots, firming it well about them. If the earth is dry, use plenty of water in the hole.

As before explained, the tops of trees should be well pruned back, just before or after planting.



CUTHBERT RASPBERRY
PLANTS

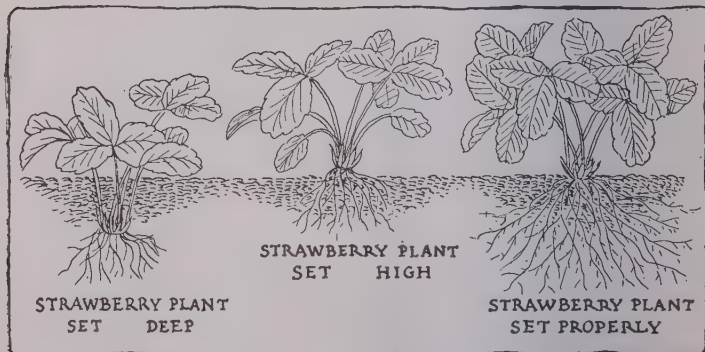
Heeled in.—U. S. D. A.

Small, soft plants such as asters, strawberries, cabbage, etc., will be benefited by removing the larger leaves, or as in the case of asters, cutting back the tops of the plants.

Soaking the Roots.—Trees and plants that have dried out somewhat in shipping will be benefited by soaking the roots in water for several hours before planting. Let roses soak over night, after they have been received and plant the next day.

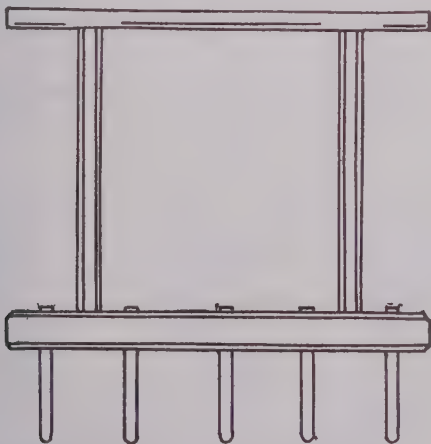
If the trees have become so dry that the bark is shriveled, they may sometimes be saved by burying them completely in moist soil, removing as soon as the bark becomes plump.

Vigorous young plants and trees stand transplanting very much better than older ones. Where a large amount of transplanting is to be accomplished, the aim is to set the plants as rapidly as possible, in a manner to insure continuous growth. The spade, hoe and dibber are generally used for this purpose where there is a limited amount of work.



Setting Small Plants.—Small plants, cuttings, root grafts and the like may be set in furrows made with a tool designed somewhat like a marker. The teeth or dibbers are made of steel and of a size to make a suitable furrow.

A line is stretched to insure straight rows; the dibber is set next to the line and forced into the soil with the foot. The group of dibbers is then drawn back and forth for a short distance, until the trenches are deep enough and the operation is continued down the row. Planters follow behind, setting and covering the plants, firming the soil about them. There is no tool so efficient in setting plants and firming soil about them as the hands. The next best tool is the feet, when greater pressure is required in firming soil about plants or seeds.



**MARKER FOR MARKING-
ROWS IN FIELD**

Horse drawn and tractor machines are now made for large plantings that set plants at varying distances, as desired, in rows, and the rows any desired distance apart, setting several acres a day; the acreage capacity governed by the distance apart the plants are set. The planters are operated by three men.

The planters carry a barrel of water, so the plants are wet as set. One man guides the horses or operates the tractor. Two men are seated close to the ground behind or in front of the machine. The machine opens the furrows two at a time, one row for each man. A box near the men holds a supply of plants. The men set the plants in the opened furrows as the machine moves along, and the machine covers the soil about the plants as they are set.

Small plants such as cabbage can be set as rapidly as a good stepping team of horses will walk. Vegetable and flowering plants are set by these machines, also dahlia tubers and gladiolus corms. Iris and other plants may also be set with these machines.

Mulching.—Plants when transplanted should not be allowed to dry out. Trees, and in fact most transplanted plants will be benefited by mulching as soon as they are transplanted. Trees set very early in the spring should not be mulched until the ground has become somewhat warm.

POTTING

Potting.—In potting plants, always use clean pots. If the pots have been used previously, see that they are thoroughly scrubbed with a scrubbing brush and water, inside and out. A revolving brush, spindle shaped that will go inside of the pots is a time saver. Where many pots are used, it will pay to make or purchase a machine with a revolving brush, operated by foot or other power, for cleaning pots.

Rooted cuttings are usually taken from the propagating bench and potted in thumb pots, pots two inches in diameter

at the top. When the roots fill these small pots, the plants are repotted or as commonly called, "shifted," in pots of larger size. In larger pots, four inches in diameter, a piece of broken crock is placed over the drainage hole, to prevent the soil washing out. If carefully watered, and if the plants are marketed when well developed, the piece of crock in the bottom of the pot is not necessary. In a greenhouse establishment, where hundreds of thousands of pot plants were grown in pots of all sizes, scarcely a piece of broken crock was used over drainage holes, except in large pots where the hole was unusually large.



**PLANT POTTED
TO ONE SIDE -
POT TOO FULL
OF SOIL**



**WELL POTTED
PLANT, STEMIN
MIDDLE OF POT,
SPACE FOR WATER
AT TOP**



**POORLY POTTED
PLANT, ROOTS
CRAMPED, AIR
SPACES AT SIDES**

In pots five inches in diameter, a number of pieces of broken crocks may be placed in the bottom before putting in the soil.

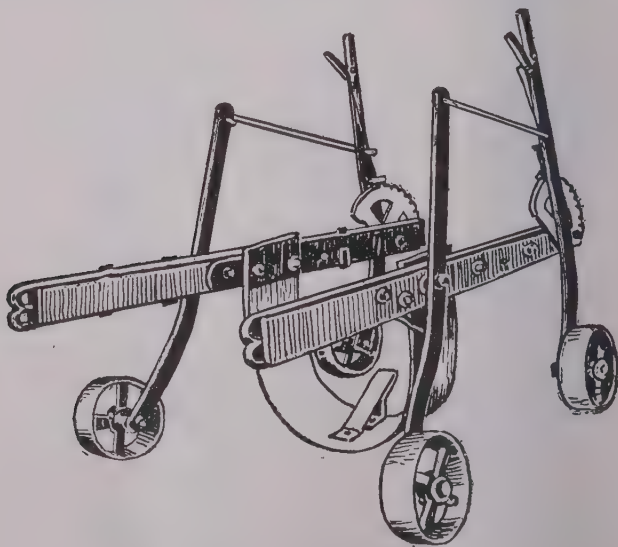
Potting soil is best produced by a compost heap. This consists of sods cut from an old pasture, turned face down, two or three layers. On this layer of sod place a foot of stable manure. Build a good sized mound in this way, alternating layers of sod

and manure. Left for two years it is ready for use. Sift through a coarse sieve and add sifted sand—one part sand to four parts compost material, for ordinary stock. This should be well mixed.

A sifted pile of compost is made on the potting bench. The sand is thrown over this and the pile is then shoveled over, making another pile. The pile is thus shoveled back and forth several times until thoroughly and evenly mixed.

Some plants like the cactus will require more sand and others may require less. Observation alone will tell just what mixtures are best.

The soil for pot plants should not bake, that is, become a hard solid mass, on drying.



TREE DIGGER

*Chapter XIV***PRUNING**

Pruning is one of the very important operations in plant culture. Before any pruning is done, the operator should know the reason for the operation.

The successful pruner is developed from close observation and practice. The forester prunes and thins out his trees to obtain long trunks of good diameter, free from knots and decay. And more foresters and cultivated forests are needed in North America.

Landscape gardeners endeavor to produce specimens or groups of good form. The fruit grower's aim is to produce the greatest quantity of best quality fruit and maintain his plants in healthy condition, while the florist's aim is for flowers usually, instead of fruit and also for attractive specimen plants.

Ornamental trees need little pruning.

Shade trees having branches that hang down over roadways or walks or the lawn, to interfere with free passage under them, require pruning to relieve that situation. Otherwise they need little or no pruning.

Most coniferous evergreens spread their lower branches down close to the earth. To cut off these branches disfigures the trees and spoils their natural beauty.

Fruit trees are pruned to obtain the maximum number of perfect specimens of the fruit. Pruning is also necessary at times, to save the life of a tree.



**DISBUDDING CONIFEROUS
TREES IN SPRING TO CAUSE
DEVELOPING OF LATERAL BUDS**

Fruit trees should generally be pruned so as to form low heads for ease in picking the fruit and spraying the trees. Light must be admitted to the head for the benefit of the fruit and also so the foliage and twigs may function properly. For lack of light, interior leaves and twigs will die. The foliage must have light to keep up the supply of plant food.

Overbearing of fruit trees is likely to produce a period of rest or resuscitation, with a light crop of fruit or no crop the following season. If permitted to continue, the every-other-year bearing habit may be established in the tree, which cannot very well be corrected. Thinning the fruit in abundant years is the remedy, removing the surplus fruit when it is very small.

Pruning and heading back tends to make trunk and limbs heavier.

Ringing to produce fruit on trees should not be practiced. If the trees are old and it is planned to cut them out, ringing a season before they are removed may give somewhat better fruit.

Pruning should begin when fruit trees are planted and the pruning should be practiced regularly thereafter as required. By this method it will never be necessary, except in the case of accidents, to remove large branches.

Removing large branches is objectionable because it exposes large and dangerous wounds. It opens up the tree so much that scale is likely to be troublesome and it gives borers a good chance to work.

Peaches should be pruned when planted. After the first season's growth, the young trees, in New York State, should be permitted to grow as much as they will until they come into bearing. The custom of pruning back the wood after the first season's growth is not wise, according to the recommendation of the New York State College of Agriculture. If that is so in New York, no doubt it is the method to pursue elsewhere. Such pruning delays bearing and may cause too late and tender growth. This, of course, increases the danger of winter-killing.

The open head system seems best, as it allows a more complete renewal than does other methods. It provides new healthy wood farther down on the main branches. The center should be kept open at the top, and the branches may be cut back to prevent them from getting too tall, but otherwise little needs to be done until the trees start to bear.

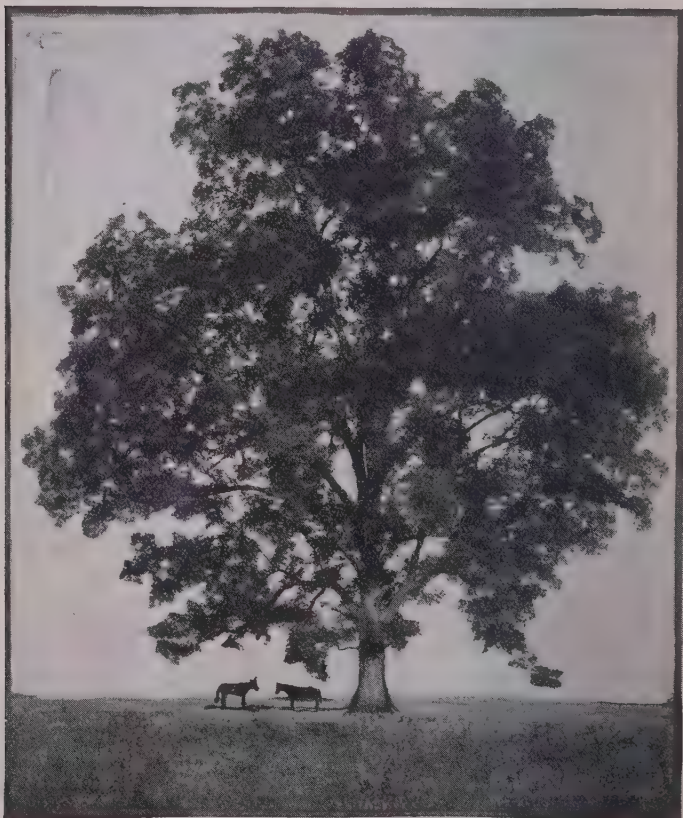


APPLE TREE UNPRUNED WITH HEAD
TOO DENSE TO ADMIT LIGHT



APPLE TREE PRUNED WITH OPEN
HEAD TO ADMIT LIGHT

Young trees in New York State are usually pruned to a whip when they are set, or if the side branches are strong, they are often left and cut back to three buds. Buds which are not



BUTTERICK PECAN TREE
In Illinois

wanted for future branches may be rubbed off during the first summer, and trees that get this kind of treatment usually grow larger than those that are severely cut back.

Fruit Trees for Shade.—Fruit trees, apples, cherries and plums particularly, trimmed with high heads, so as to allow



MONTMORENCY CHERRY TREE
After pruning

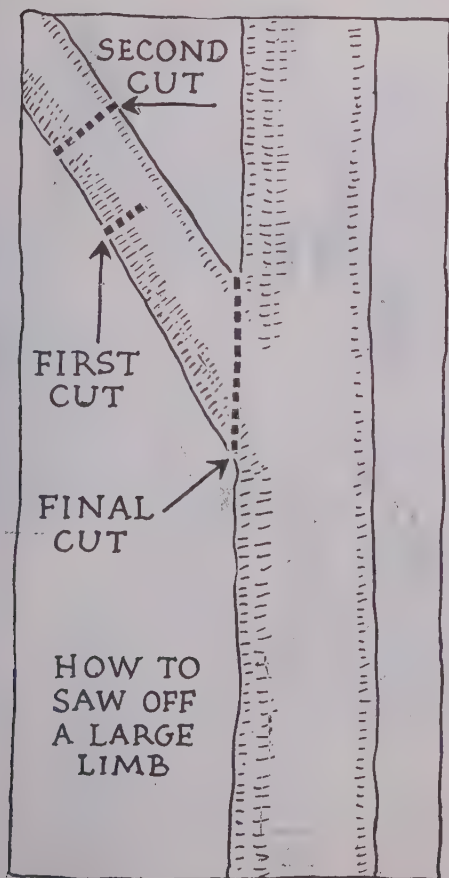
ample head room under them, afford as good shade as purely ornamental trees. In addition to their shade these trees yield an abundance of fruit. This is true also of nut trees—hickory, beechnuts, walnuts, English walnuts and pecans, where they can be grown. Hickory, walnut and beech are valuable timber woods.

In pruning small twigs and branches, use a sharp pruning knife, making a clean smooth cut that will quickly heal. The cut should not be made too high above the bud that is left. If it is, the stub will die back to the bud and likely result in the death of the bud. If too near the bud, the stem will dry out and possibly kill the bud, in either case necessitating a second pruning. The place to cut will depend on the plant to be pruned. Peach and grape need longer stubs than hard, close grained wood like the apple and pear.

Cutting Large Branches.—If a large limb is cut from the top and close to the branch or trunk to which it is attached, when about half cut through, the branch will fall of its own weight and most likely tear down a section of the limb or trunk, causing damage that cannot be overcome.

In cutting a large limb, the first cut should be made some distance out on the limb to be removed and on the under side. Cut about half-way through. Then a little farther out make a cut from the top. When the limb falls as it is cut from the top, the cut first made on the under side will prevent splitting. The stub can then be cut off close to the limb to which it is attached. Limbs of this kind should be cut with a sharp saw.

When large limbs must be cut off, the final cut should be made as smooth as possible and close to the trunk or branch from which it is cut. Dead or dying branches should be removed promptly. Branches that interfere should also be removed.



METHOD OF REMOVING A LARGE LIMB

Removal of Large Limbs Showing Proper and Improper Methods

Fig. 1—A heavy limb improperly cut, showing the stripping as the limb falls.



Fig. 2—Removing a heavy limb. The first cut on the under side is to prevent stripping.



Fig. 3—The oval scar has been somewhat pointed with a gouge above and below to facilitate healing.

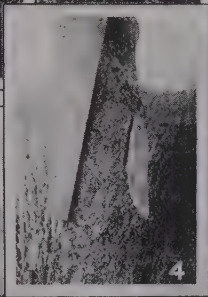


Fig. 4—The third cut, to remove the stub shown in Fig. 5 has been completed.

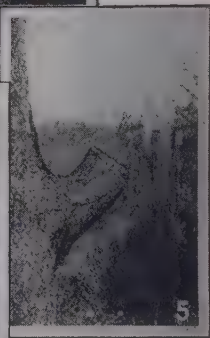
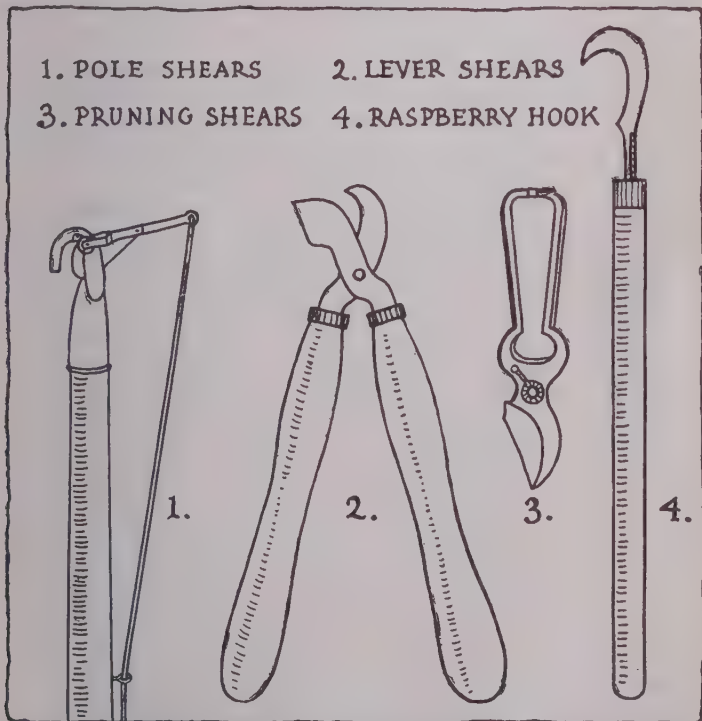


Fig. 5—The second cut completed. The limb has fallen without stripping.



Fig. 6—Improperly cut and treated stubs. The bark of these stubs died mainly as a result of severing all the food-producing organs (leaves) above. Decay has entered trunk from these stubs.—(U. S. D. A.)

The best time to remove large limbs is about six weeks before growth starts in the spring.

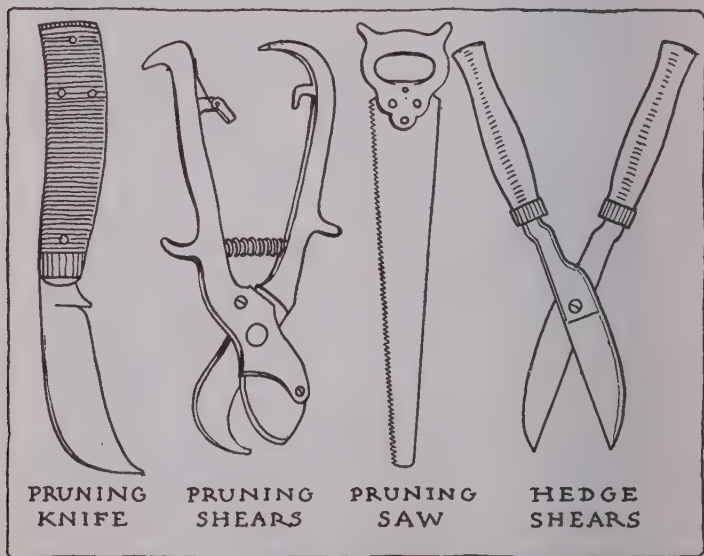


Burn Prunings.—Gather up all prunings promptly, place them in a safe place and burn them. To permit them to remain means the harboring of insects and disease which will cause damage later.

To prune intelligently, particularly fruit, it is necessary to know buds.

Pruning Tools.—A good saw, with a single edge, pruning shears, pruning knife, hedge shears for hedges, lever-shears, pole pruner and raspberry hook, are required. Never use an axe or hatchet in pruning.

Saws are needed for large limbs; knife and shears for small branches, shrubs, etc.; lever-shears for stout branches and sprouts on trees; pole pruner for cutting back tall shoots; raspberry hook for cutting out the old canes of raspberries and blackberries as soon as the crop has been gathered.



Wounds.—In pruning the cut should be made smooth and close to the limb or trunk from which the branch is cut, so it will be healed from the cambium of the latter. Wounds so large they cannot heal promptly, should be painted over to preserve the wood until it is covered with a layer of bark.

The cambium layer is the new growth in the stem by which it increases in diameter year after year. The cambium forms a callus over tree wounds, from the outer edge to the center, finally entirely covering the wound, if it is in such shape that that is possible. This affords protection to the wood beneath checking evaporation and preventing decay. Decay once having reached the heartwood, will soon destroy the wood of the trunk. It is the beginning of the end of the tree.

Painting Wounds.—White lead and linseed oil were formerly used for painting large tree wounds. Experience has proved this ineffective. Asphaltum, creosote and carbolineum are now used.

Asphaltum requires heating until it melts. It is applied with a brush or broom. The surface of the wound is completely covered extending over the edge of the living tissue.

Liquid asphaltum for summer use is made in the following proportions: 10 lbs. solid asphaltum; 20 lbs. Varnolene, a compound petroleum. Melt the asphaltum. When melted remove from the fire and add the Varnolene cautiously, as it is inflammable and an inflammable gas is produced. Stir until of a uniform consistency.

For winter use, one part asphaltum to two and one-half parts Varnolene are the proportions.

Fluid asphaltum may be made by using linseed oil instead of Varnolene. One part asphaltum to two parts linseed oil by weight. There is less danger from inflammable gases forming with linseed oil, but even this is likely to take fire.

Wounds made in removal of fire blight should be disinfected with corrosive sublimate, a deadly poison which must be handled with great care, one tablet to a pint of water, or Bordeaux paste may be used. The wound should then be covered with grafting wax.



PEACH TREE—FIRST SEASON'S GROWTH

Cross lines suggest suitable points at which to prune in dormant season

Chapter XV

PRUNING METHODS

Pinching.—Soft plants such as dahlias are pruned by simply pinching off shoots that are not wanted or pinching off flower buds, called “disbudding” so the strength of the plant may be used to grow larger flowers from the buds that remain on the plant.

Plants that flower at the terminal points, such as rhododendrons, hydrangeas, etc., should not be pruned by pinching as it will reduce the size of the flower clusters.

Deflowering.—Removal of flower buds is also sometimes called “deflowering.”

Trimming.—Young trees when received from the nursery are “trimmed” by pruning back the branches and the roots if broken.

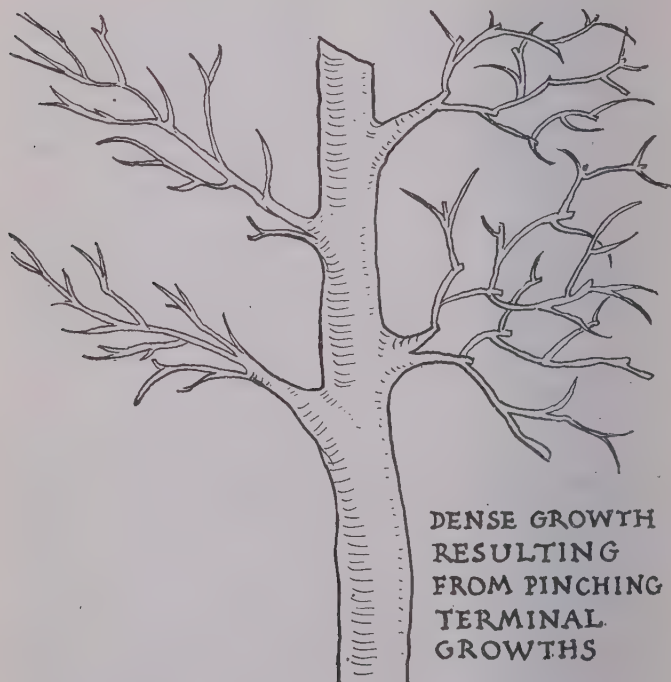
Suckering is removing the shoots (suckers) that start from the base of trees or shrubs.

Ringing is the removal of a narrow band or ring of bark from about a limb or trunk of a tree, to stop the flow of sap.

Ringling is not advised except in cases where the tree or limb so treated is to be killed.

Sprouting is the removal of unwanted shoots or whips that start from the upper limbs of vines or trees, such as are frequently seen on apple and cherry trees.

Notching is cutting a notch immediately above or below a bud to modify growth.



Root Pruning.—Shortening the roots of trees or plants in the soil is called root pruning. The object of root pruning is to encourage a mass of fibrous roots in a small space on young trees in the nursery, so they will make a vigorous start when transplanted. Root pruning is also practiced to check growth.

Root pruning is accomplished by deeply inserting a spade in a circle about the plants, to cut off the extremities of the roots. In large trees it may be necessary to dig a trench around them in order to cut the root ends.

Thinning fruit is removing part of the fruits from a plant so the remaining fruit will grow to larger size and be more nearly perfect in form and color. It also prevents exhaustion of the plant by overbearing. This is also called *de-fruiting*.

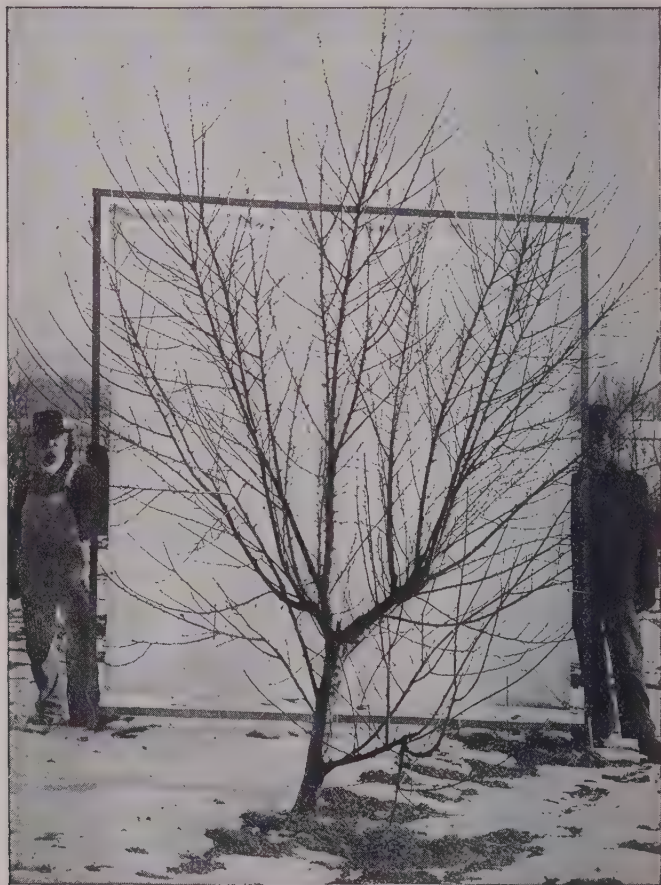
Pruning is resorted to, to keep plants in proper form or to change the form, which is *formative pruning*; to promote flower buds or the growth of branches, which is *stimulative pruning*; to affect maturity, which is *maturative pruning*; to fortify the plant against high wind or to check disease, which is *protective pruning*.

Formative pruning regulates the form of the plant, keeping it in its natural shape, or preventing forms that will break with their own weight, as bad crotches in trees which split; for compactness, for upright slender form, or for low spreading, open heads.

In peach and apple trees one of the objects of pruning is to keep the trees low so they can be easily sprayed, the fruit picked without difficulty, and the heads open to let in sunlight to color the fruit properly.

A spreading form is obtained by pruning the branches to outside buds. To make a dense compact head the pruning is chiefly of the terminal buds.

Symmetrical pruning is to keep the plant in its natural form. Cutting back the tops of trees tends to make a larger trunk.



BEFORE PRUNING
Eight year old peach tree.—U. S. D. A.



AFTER PRUNING

Eight year old peach tree.—U. S. D. A.

Topiary work is pruning such plants as lend themselves to this treatment, shaping them into various forms. It requires constant care to keep the plants in form. Privet lends itself to this style of work, also yew and boxwood.



BEFORE PRUNING

Eight year old peach tree.—N. Y. State Col. Ag.

Stimulative pruning is most generally used for encouraging flower buds. Young, seedling apple trees to fruit early, need a check of some kind early in the growing season, to encourage setting of fruit buds, the flowers appearing the next season. Dry weather sometimes is sufficient. Root pruning may be resorted to, or the tree having previously been well pruned, summer pruning is resorted to, pinching off the tips of all new growths.

Weak plants are sometimes strengthened by reducing the growing portions, so the roots can well take care of those remaining.



AFTER PRUNING

Eight year old peach tree. Vigorous pruning encourages thrifty annual growth on which the fruit buds are borne.—N. Y. State Col. Ag.

Pruning is often desirable to prevent formation of flowers. Strawberry plants set out in the spring will do better if the flowers are picked the first season. Cuttings should not be allowed to flower until they develop into well rooted plants. Tobacco plants are “topped” to make the leaves grow larger. Topping onion plants produces larger bulbs.



COLUMBIA RASPBERRY

Showing spacing of plants and methods of pruning.—U. S. D. A.

Chapter XVI

PRUNING SEASON

BUD LOCATING

Pruning Season.—The question constantly arises, when is the time to prune?

Pinching and disbudding may be done any time as needed.

In pruning fruit trees in orchards, where pruning is done systematically and regularly, the work is done in the dormant season. for two reasons: In the removal of large branches it is considered least injurious when the trees are dormant. At this season, also, the fruit grower has the most time to attend to this operation. Early spring, just at the close of the dormant period, is considered the best time for pruning, as healing of the wounds is most rapid at the beginning of the growing season.

Pruning should not be done at a season when the sap flows freely from the wounds, as this weakens the plants.

The bleeding of pruned grape vines is an illustration and this occurs also in maples. Plants of this kind should be pruned when entirely dormant, in the winter.

Conditions, soil and climate make it impossible to have a set of rules that can be followed closely. What is the rule in one locality may not answer at all for another. Winter

pruning may be practiced in some parts of New York and South. Where the winter is dry and severely cold, winter pruning may result in severe winter killing, as in the cold regions of the plains.

In hot, dry regions sun scalding has to be considered and not much tree surface may be exposed by heavy pruning. In some parts of Washington State the trees grow so late the wood hardly ripens and winter pruning adds to the excessive wood development. Summer pruning is kept up and sometimes root pruning is necessary. In the dry sections of the state, winter pruning is necessary. Then also, plants at different ages require different pruning.

Winter pruning tends to increase branch bud formation and summer pruning tends to increase fruit bud formation.

Severe pruning of branches tends to increase wood production, called vegetative growth. Weak plants are aided by severe pruning. Severe pruning of the roots reduces vegetative growth.

Some shrubs flower on the wood of the present year's growth. These may be pruned severely after flowering. Included are althaeas or rose of sharon, genistas, etc.

Another class of shrubs produce their flowers on wood and from buds produced the previous season. These include such shrubs as lilacs, weigelas, calycanthus, forsythia, deutzias, honeysuckles, dogwood, rhododendrons, azaleas, etc. If these are pruned in the early spring, the flowers will be cut away. If the last season's growth of the wood was strong, some pruning of the branches by shortening may be done and still permit sufficient buds to remain for a good show of flowers. When plants of this kind are pruned, it should be after they

have flowered, cutting out any dead branches, throwing the strength of the plant into the new wood that will produce flowers the next year.

Hedges may be trimmed any time when needed.

In autumn pruning, small twigs are likely to kill back considerably, but seldom is this the case in spring pruning.

Young trees set in the autumn should not be pruned back as severely as those set in the spring. Autumn set trees may be cut back again before growth starts in the spring. The wounds heal best when the stub above the bud is very short.

Summer pruning of grapes consists of the removal of surplus shoots. This may be begun with the first growth in spring, but should not be done when the wood becomes firm.

BUDS AND BUD LOCATING IN PRUNING

Buds are rudimentary parts of plants which produce a leaf or clusters of leaves; a flower or a cluster of flowers; leaves and flowers together; or a stem. The first are leaf buds, the second flower buds, the third cluster buds and the fourth stem buds.

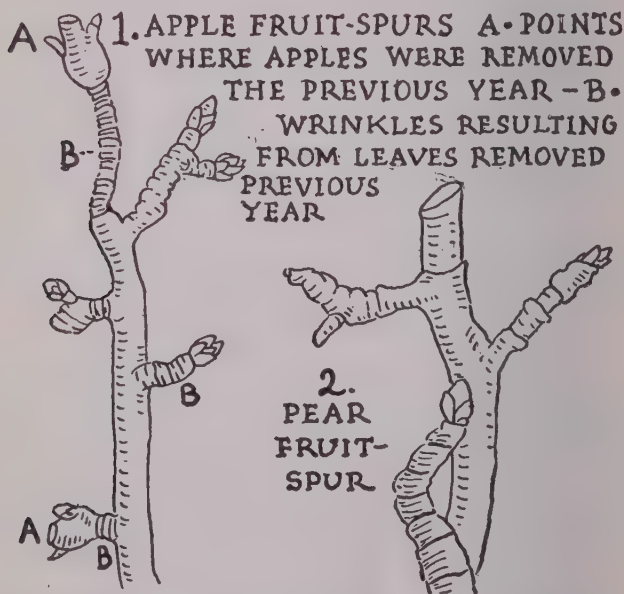
Buds are said to be axillary or lateral when produced in the leaf axils and terminal when borne at the ends of shoots.

Dormant buds are developed during the growing season and remain dormant during the winter following.

Latent buds do not break into growth except under unusual stimulation.

The terminal bud is the first to expand into a twig and generally it is the strongest, the next nearest to it being next and the weakest from the lowest lateral bud.

Adventitious buds are buds produced at unexpected locations on stems or roots. It is adventitious buds that develop water sprouts from the branches or suckers from the roots, when trees have been pruned severely. On plants that have



been budded or grafted, all suckers should be removed as soon as they appear. The stock from which the suckers start is likely to be of a more vigorous character than the cion, and less desirable and if left to develop, may grow so rapidly as to result in the death of the cion, taking the strength of the roots, itself.

Blossom Buds.—In pruning it is necessary to know where the blossom buds are located. Otherwise loss of fruit may result.

Peach, apricot, Japanese plum, apple and sometimes pears, currants and gooseberries have axillary buds.

Apple, pear, cherry, apricot and currant sometimes have terminal buds, mainly on spurs.

Bud scars reveal the age of shoots until the branches become old. If the terminal is a fruit bud the branch is likely to kill back to a lateral twig. Some varieties of apple and pear have fruit spurs of much greater diameter. Scars are left by bud scales which fall off as the terminal bud develops. If the terminals are wood buds the growth is straight, but the blossom buds are not. If the terminal bud is removed, an axillary bud will naturally develop a shoot which will be more or less at an angle, particularly in apple or pear spurs.

When fruit matures, a scar is left where it was attached to the fruit spur. Short twigs which at some time bore flowers, kill back to the main stem at times and fall off, leaving scars like those left by matured fruit. If the scars are single, they are likely those of twigs, if in clusters more likely of flowers or partially matured fruits surrounding the scar left by a matured fruit.

A check in growth of the tree, particularly during late spring or early summer before the fruit buds are set, as by drought, causing slow growth, tends to encourage fruitfulness. This is one reason for summer pruning, pinching off the tips of branches. Once twigs begin to bear, they will continue to do so.

Heavy pruning encourages wood growth at the sacrifice of fruit production.

Pome Fruits.—Buds of pome fruits such as apples and pears, bear their cluster buds on the end of little twigs or fruit

spurs. The flowers appear surrounded by leaves. Only one or two of the flowers will develop a fruit and the spur which develops a fruit this year is not likely to the next season. A bud of a branch appears near the fruit spur and the following year produces a cluster of buds. In this manner fruit spurs are supposed to bear every other year, for years, and great care should be taken to see that they are not injured or destroyed.

Stone Fruits—The buds of the stone fruits such as peaches, apricots, etc., are not surrounded by clusters of leaves. Cherries and plums may have a few leaves when the flowers appear. In buds which do not contain leaves, the flowers are not well protected by scales, which is the reason peach buds are so easily winter-killed.

Peaches bear their blossom buds singly at the side of a branch bud, or more often in pairs, a branch bud between them. Apricots and some plums rarely develop terminal buds and the axillary buds of these and peaches may produce flowers.

The nearest axillary bud takes the place of the terminal bud, when that fails to form, and extends the branch.

In strong growing peach trees the blossoms are nearer the tips than the bases of the twigs. In weak growing trees the buds are scattered along the twig.

The fruit bearing area of the peach differs from the apple in that each season it is farther out from the center of the tree. Bearing wood should be maintained on the branches, which should not extend too far out, by somewhat more severe pruning than on apples. Severe pruning of peaches in young trees was formerly the practice. Recently entirely different treatment has been recommended by some authorities.

Plum buds are borne on short spurs of last season's growth. Some species produce fruit buds in the axils of the leaves. The side buds are usually the flower buds, but side buds may prove to be a twig.



A PEACH TREE

Strong, stocky branches and an open top

Cherry fruit buds are borne on axillary short spurs, the branch bud being the terminal bud. Some sour cherries form flower buds on new growths.

By careful observation and study, peach, plum and cherry fruit buds may be found in the autumn and sometimes quite early. Apple and pear fruit buds are not easily recognized until about December.



DELICIOUS APPLE TREE AFTER TWO SEASONS' GROWTH
—U. S. D. A.



SAME DELICIOUS APPLE TREE AFTER PRUNING
(See preceding page.)—U. S. D. A.



SAME DELICIOUS APPLE TREE IN FOLLOWING JULY
A good framework for the development of a strong, well-branched tree
—U. S. D. A.



LOWER PART OF RASPBERRY CANE

Showing dormant leader buds from which shoots will grow in the early summer

—U. S. D. A.



LOWER PART OF RASPBERRY CANE

Showing the new canes that have started from leader buds.—U. S. D. A.

Plants that flower on wood more than one year old such as apples and pears, if too severely pruned, will produce an excess of new wood at the expense of flower buds.

Grapes are pruned in winter, removing half to three-quarters of the entire vine. The fruit is borne from buds on wood of the previous season's growth. The pruning should be completed early. Late pruning permits the vines to "bleed" which weakens them.



BLACK RASPBERRY

Showing the canes rooting at the tips.—U. S. D. A.

Vigorous canes of medium size with plump buds, give the best results. Cut out the weak canes, keeping the bearing wood near to the trunk.

The bush fruits include raspberries, blackberries, dewberries, etc., called brambles, and currants and gooseberries. The brambles produce new canes from their crowns. The canes develop one year, produce fruit the next, and die.

Pruning consists of cutting out at the surface of the ground, all the canes that have produced fruit, as soon as the crop has been harvested. This throws all the strength of the roots to producing vigorous fruiting canes for the next season's crop.

Currants and Gooseberries bear their fruit principally on last season's wood. Old wood that has fruited two or three times is cut out.

The Quince should be headed low and some may consider it a bush fruit rather than a tree fruit. A short trunk is preferred by some growers, because it makes handling easier. The interior growth is thinned out every winter and if needed, the trees are headed back. This thins the fruit as the flowers are co-



BLACK RASPBERRY

After pruning, leaving two buds to each lateral branch.—U. S. D. A.

terminal, borne on a leaf shoot which sprung from the terminal winter bud and after it grows a few inches, a flower appears. Cutting off all the tips will likely remove too much fruit.

Heads of trees are formed as desired, by the manner of pruning. To spread the heads, prune to outside buds. For dense heads, prune to inside buds. To raise branches prune to inside buds and to lower, to buds on the lower side.

Chapter XVII

PLANT BREEDING

Wild plants are very much alike, but a careful examination will show that some specimens are much more robust than others; some have larger fruits than others. Some of the best, when cultivated, will still further improve under the more favorable conditions in which they are placed. Seeds of these when planted will produce some weak and inferior plants and possibly some superior. By careful watching and selecting the best, replanting their seed, improvement may be made.

Our fine big strawberries were produced in this manner, through the care of breeders who have nursed them along. Sometimes plants will sport, and develop a branch bearing a somewhat different flower or fruit from the parent. The observing cultivator propagates this and a new variety results. Sometimes these new varieties revert to the parent type and are lost.

A fixed variety is maintained in some plants through propagation by division. Flowering plants and many fruits are propagated and perpetuated in this way. Other plants such as radish and lettuce must be produced from seed to permit them to be generally used and these become fixed by careful, continued selection.

A bean is noticed having a decidedly different character from its type. All the seed of this plant is saved and planted the next season. Some of the plants from this seed will probably resemble the parent. The seed from the best of these is saved and the operation repeated several times. After a while the

variety becomes fixed and reproduces fairly true to type from seed. Then the new variety is established.

Careful seed growers never fail to "rogue" their crops, removing any plants that vary from the type they are endeavoring to produce.



IMPERFECT (PISTILLATE) BLOSSOM—STRAWBERRY

Having no stamens. Will not produce fruit unless grown near staminate varieties.—U. S. D. A.

Causing Plant Variations.—As stated, good cultivation induces variations that would not be likely to appear in the wild state.

The potato and dahlia for a long time propagated by division, not having become fixed by selection, vary greatly

when grown from seed and variations obtained in this way are perpetuated by propagating them by means of divisions of the tubers or of the plants.

Crossing of Varieties.—Variation can be induced by crossing or cross-pollination, called cross-fertilization of varieties or



PERFECT (STAMINATE) BLOSSOM—STRAWBERRY

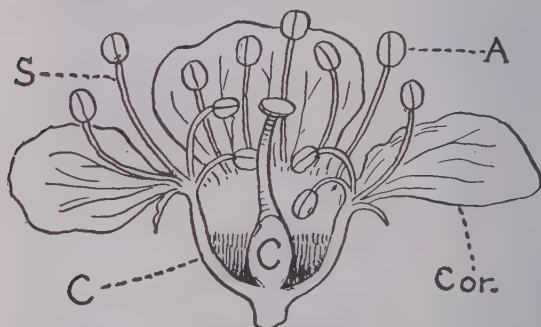
Having both stamens and pistils. Will produce fruit.—U. S. D. A.

species. This process secures fecundation of the germ cell of a plant of one variety with the pollen of a different variety and the plants resulting from the seed may show a resemblance to one plant or the other, or may produce flowers or fruit quite different from either. Very often the good qualities of both parents may predominate. There is no fixed rule that is

absolutely reliable. The results sometimes may be about as expected, but more often they will not be.

Pol.inating.—The crossing of plants results from placing pollen from the anthers of one flower of a related species, upon the stigma of another variety.

Crossing is sometimes spoken of as being accomplished by



CHERRY-BLOSSOM SECTION

C. CALYX

S. STAMENS

Cor. COROLLA

A. ANTHER

grafting. In grafted plants the stock does not change its character and if it does the change is slight; the cion does not change its character perceptibly.

Special instruments are made for the cross-pollinating of flowers, including camel hair brushes, long, fine pointed scissors, tweezers and cloth bags. It is necessary to prepare the flowers to prevent self-pollination in perfect flowers by removing the anthers.

Anthers are the tops of the stamens. These are removed before the pollen on them forms. They are clipped off carefully

with scissors points. To do this the petals of the flower may require opening with forceps, or they may be carefully removed. In some flowers like the pea, pollination occurs before the opening of the flowers. In flowers of this kind the work must be done very early and carefully. The operation is called emasculation. The blossom is placed in a very light cloth or paper bag, which is tied on to the plant when the anthers are removed. The bag is only removed for pollinating.



**FLOWER
PROTECTED
BY BAG**

The pollen should be applied from twenty-four to forty-eight hours after emasculation, according to the development of the flower. The pollen is applied on two days in succession to make certain of results.

The pollen is sometimes applied by transferring it on a camel's hair brush or it may be applied by using an anther containing mature pollen as a brush, rubbing it on the stigma of the emasculated plant.

The stigma is the apex or top of the column in the center of the flower, called the pistil. The base is somewhat swollen and is called the ovary, the part connecting them is the style. In the ovary is the ovule that becomes the seed. Some flowers have several pistils and many ovaries containing one or more ovules.

Pollination in the open air is usually performed in the early morning when the air is still. Pollen is flying about in the air when there is a breeze stirring and may defeat the object of the operator.

After pollination the flower is again enclosed in the bag, and if the result has been successful it will be shown by the swelling of the ovary.

A careful record should be kept of the operation and the name of the parent plants. This will be found useful later.

The seedlings should be grown on, the seed saved and a second and third generation produced, before discarding the plants. The seeds of desirable specimens should be treated likewise.

When varieties are obtained that are satisfactory, these may be fixed and multiplied by cuttings or grafts. In plants propagated by seed, several generations may be needed before a uniform strain can be depended on from seed.

Chapter XVIII

GROWING TREES FROM SEED

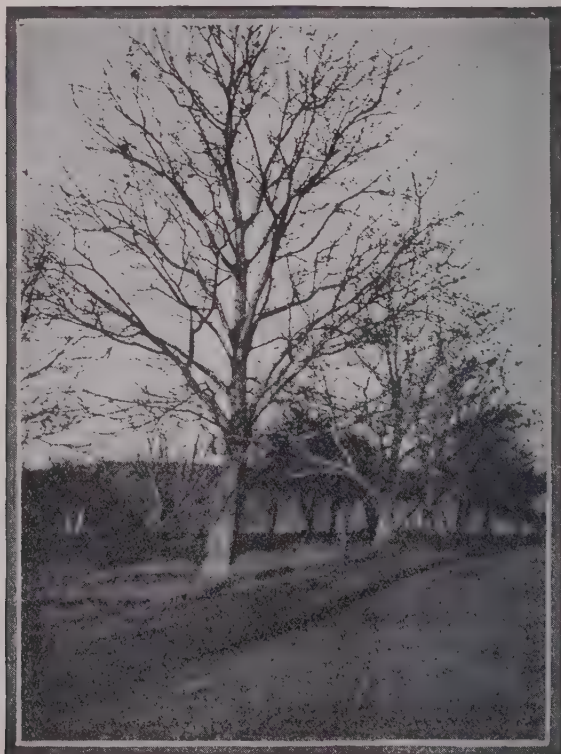
Most forest trees ripen their seeds in the autumn. When the autumn winds blow and the rains come the seed falls to the ground. Then the leaves fall and cover and protect the germs of new life. Some trees, however, produce their seeds in the spring and they must be planted then. Most tree seeds need to be planted as soon as they are ripe and dropped by the trees.

Seed of nut bearing trees, acorns, hickory, black and white walnut, chestnuts, etc., can be planted in the open ground, if it is rich mellow soil. The wood of these trees from now on will be from cultivated trees, not trees of the forest, as they have practically passed.

The ground should be plowed and thoroughly cultivated, or in small spaces, spaded and made fine. Make shallow drills at any convenient distance. If cultivated by hand they need be only eighteen inches apart. Large areas should have the rows far enough apart to permit of horse cultivation.

The planting can be done in the autumn and the bed mulched with straw, leaves, marsh hay or similar material. This affords some protection and prevents baking of the soil after spring rains, keeping the ground mellow.

The mulch should be removed in the spring so it will not interfere with the growth of the seedlings.



ENGLISH WALNUT TREE
Avon, New York

Small tree seeds such as maple, linden, white ash, tulip, magnolia, etc., require more careful handling. The soil should

be thoroughly pulverized and thrown up into beds about three feet wide and any desired length. Place a board across the bed and make a drill across the bed with a sharp stick drawn along the edge of the board.

Sow the seed evenly in the drill, cover lightly and turn the board forward for a new drill. The drills may not be more than about eight inches apart. Mulch the beds with straw, if planted in the autumn and transplant the following season.

Oily Seeds.—Magnolia seed and those having an oily covering will not grow well unless this is removed. When seeds of magnolia are gathered with the pods, put them in a pail with enough water to barely cover them. Stir occasionally. In a few days the pulpy covering will be softened and may be rubbed from the seed. Then mix lime or wood ashes with the seed to cut the oily matter, and plant the seeds.

Another plan is to mix the seed with a quantity of unleached wood ashes and place in a cool cellar and keep moderately moist until spring, when the alkali will have removed most of the pulp.

Elm and Maple.—Elm and red and silver maple ripen their seed late in the spring or early summer. They should be planted immediately as they will not keep long. Silver maple planted in June will frequently grow fifteen to twenty inches by October.

Birch seed can be kept in sand in a cool place and planted the following spring.

Starting Native Hardwood Trees.—The least expensive method of starting native hardwood trees such as black walnut,

hickory and oak, is by planting seeds where the trees are to grow.

Collect the seeds, which are the nuts or acorns, as soon as the frost causes them to drop from the trees and plant them at once. In planting cover the seeds four times their diameter.

Maple, ash, locust and other light seeds should be started in a nursery bed, sowing the seed as soon as it is ripe. The trees are then transplanted when large enough.

Keeping Tree Seeds.—Some tree seeds preserve their vitality for years, others for but a short time. Some must be kept dry as moisture starts the germ and unless planted at once, they spoil. Others like the chestnut, will be spoiled if allowed to dry. Evergreen seed, rich in oily, resinous matter, must be kept dry and well ventilated. The seed should be placed in thin layers on the ground and covered with partly decayed leaves or mixed with sand and kept in a cool place.

Evergreens of some varieties may be grown from seed. The seed may be sown in August in the greenhouse. When of sufficient size the seedlings are transplanted into flats or pots. The greenhouse is well shaded, if the plants are kept inside during summer, lath shades or cloth covers being used. Or, the seedlings may be set out in carefully prepared beds in the open ground, shaded with lath screens or cloth, covering the entire bed. During winter a protection of peat moss should be given, or decayed leaves may be used, the seedlings set out in nursery rows the following spring.

The seeds may be sown in the open ground in well prepared beds and the bed mulched with peat moss so it will not dry out.

Evergreens Which May Be Grown from Seeds:

Abies	Larix	Retinospora
Biota	Libocedrus	Sciadopitys
Cedrus	Picea	Taxus
Chamaecyparis	Pine	Thuja
Cryptomeria	Pseudolarix	
Juniper	Pseudotsuga	

Experienced growers recommend autumn planting of Juniperus Virginiana or Red Cedar.

Colorado Blue Spruce does not come true from seed and plants that are off color, should be discarded.

Evergreen seedlings are subject to damping off and to prevent this careful watering and shading is required. Drought is equally dangerous. Sandy soil, using clean sand, is helpful. Charcoal is powdered and mixed with the soil by some.

Broad leaved evergreens such as rhododendrons, kalmias, azaleas, etc., are sown in a mixture of peat moss and sandy loam. Screen a light layer of peat moss over this and sow the seed directly on it. Cover with glass and give an even temperature of fifty-five degrees. When of sufficient size the plants are set in coldframes in the spring, shaded as needed and protected in winter.

Evergreen seeds, with the exception of juniper and yew, are found in the cones, at the base of the shells composing the cones. The seed is composed of a resinous or oily matter which becomes rancid unless care is taken to preserve the vitality of the seed. The seed keeps best in the cones. The juniper and yew produce small berries containing the seed.

The cone-bearing evergreen (*coniferrae*) seed prefers sandy loam rich in vegetable matter but free from rank manures. Plant in beds three or four feet wide, with walks a foot wide between them. Round up the beds in the middle, the sides

being but little higher than the walks. The seed can be sown broadcast and lightly raked in. They may also be sown in rows, sifting a light covering of soil over them, not more than an eighth to a quarter of an inch deep, pressing it down. A pound of Norway spruce should cover from twenty to thirty feet in a bed four feet wide.

The beds should be prepared in the autumn and the seed put in as early as possible in the spring.

Shade.—The seed beds must be partially shaded. If exposed to hot sunshine when the seeds are swelling and cold follows, many will rot. Where seedlings are raised in large quantities, arbors are made of posts high enough to permit walking under them. These are covered with poles which support bushes or branches of trees with the leaves on. The arbor is constructed the season before planting. Lath shades may be placed over the beds, supported a few inches above them to afford shade. These are easily removed and replaced.

Germination requires from one to two months. Sometimes the seed remains dormant for a season and comes up well the next. If the seeds fail to sprout the first year, examine them and if plump with fresh looking kernels, keep the beds weeded for the next season.

The critical period extends over six to eight weeks from the time they make their first appearance, or until they form their secondary leaves. A little excess of drought, heat or moisture may cause the stem to rot off.

Rainy, hot weather or a heavy warm rain may cause great loss. In such cases, sifting dry sand over the bed may save them.

Winter Protection.—In the autumn the beds should be covered with leaves, straw or marsh hay to prevent loss from thawing and freezing.

Chapter XIX

PRODUCING STOCK

Producing Stock.—In producing stock for grafting or budding, care should be exercised to get good seed that will grow strong roots, or the trees produced will be weak. The stock must be a kind on which standard varieties will readily unite. There is a great difference in the various fruits as to the strength of the union of a graft and the vigor of the mature tree.

Stocks Generally Used by Nurserymen

Apples, standard, Common varieties,
from seed from cider mills.

Formerly French crab apple stock was used, but this is obtained with growing difficulty on account of Federal quarantine. French seed of wild apples is still to be had.

Apple, dwarf.....Paradise
" semi-dwarf.....Doucín
Pear, standard, Common varieties or
French
" dwarf.....Quince
Quince.....Common
Apricot.....Apricot or peach
Almond Peach, plum or almond
Cherry, sour.....Mahaleb

Cherry, sweet.....Black Mazzard

Cherry trees on mazzard stock have the longest life. The wild cherries of the eastern part of the U. S. may be used.

Peach.....Peach
Plum..Myrobalan, Marianna and St.
Julian

Myrobalan does not do well in prairie sections.

Walnut.....Walnut
Chestnut.....Chestnut
Pecan.....Pecan
Citrus fruits.....Sour Orange
Olive.....Produce from cuttings
Mulberry....." " "
Fig....." " "

The seeds of wild plants produce the best stock. Seed from improved varieties are low in vitality and the seed does not germinate well. The older the variety, the poorer the seed is likely to be.

Producing plants by any form of grafting, budding, cuttings or grafts is called vegetative production. Varieties propagated in this manner for a long time, become weakened in their seed producing power. The horse-radish almost never produces seed now and the potato much less frequently than formerly.

Wild peach seeds are gathered in Tennessee and Kentucky and sold to nurserymen, from which stock is produced. Elberta seed makes good stock plants.

Seed gathered from canning factories, without consideration to the varieties, is likely to result in many poor, weak stocks that will produce short lived trees.

The longest lived peach trees are produced by planting the seed of the wild peach where the tree is to grow. Two or three seeds should be planted, to be sure that at least one will grow. Any surplus not needed is cut out. Graft the trees where they grew, without transplanting.

The flesh of stone fruits must be removed and the pits dried, before planting. Large quantities are handled by piling them up, where the pulp decays. The mass is then shoveled into tanks or tubs which are then filled with water. The pulp is washed from the pits, which are then dried in the sun and when dried, stored in a cool place until wanted.

In obtaining apple seed from cider mills for stock, the seed should be carefully examined in the pulp. If the seed has been cracked by grinding or pressing, it is worthless as it will not grow. The seed of a wild apple is to be preferred to cultivated varieties.

Cleaning Apple and Pear Seed.—The pomace is put in barrels or tubs and soaked in water, stirred occasionally so the seed may separate from the pulp and sink to the bottom. After a few days the pomace is skimmed off with the poor seeds, which float. The seed in the bottom will be good, heavy seeds.

These are passed through a sieve, with meshes just large enough to let the seed through. This will clean off most of the remaining pomace. The seed is then placed, a few handfuls at a time, in a sieve that will not permit the seed to pass. Rubbed about in this sieve the smaller, remaining particles of pomace will be removed, leaving the seed clean. Spread the seed thinly on sheets or trays to dry, when they may be placed in bags and stored in a cool, moist place. Stir frequently to prevent heating and mildew.

The seed may be sown in the autumn. If kept until spring, mix the seed with four or five times its bulk of sand and keep in a cool shaded place during winter. Freezing and thawing cause no injury if kept in sand. Seed and sand may be sown without separating and should be planted as early as possible in the spring. Sow in the open ground in a deep, rich clay loam, if that is available.

Sandy soil produces many lateral roots instead of the desired long tap root. The ground should be worked deeply before planting to encourage the tap root.

Pear seed is obtained in the same way as apple seed, also from France and Germany. The seed of the Kieffer pear makes good stock. If not obtainable from cider mills, the pears can be piled up and allowed to decay. They decay quickly in barrels. When the fruit is well decayed, the seeds are washed out in the same manner as suggested for apples. It is more difficult to manage than apple. It sometimes lies dormant the first season and then comes up well the second.

Fruit tree seed to be shipped must be sufficiently dry so it will not mold, but not so dry as to spoil its germinating qualities. Nuts bought in stores usually fail to grow because they are too dry.

Small seeds like apples are mixed with powdered charcoal, which equalizes moisture.

Cherry and plum seed is obtainable at canning factories. It should be packed in sand or moss as soon as separated from the fruit, to prevent shrivelling of the kernel.

Plum seed will stand more drying than the cherry and the peach more than the plum, but care is required to keep the kernels fresh and plump.

Fruit tree seeds vary from the parent, so they are only grown for stocks on which to bud or graft varieties desired.

Stratification.—Sometimes the seed is planted directly in nursery rows in the open ground. Sometimes the seed is sprouted during winter and then planted in the open fields in the spring.

Large seeds such as peaches are handled near where they are to be planted. The ground is carefully leveled and the seeds spread in a thin layer. The layer of seed is covered with three or four inches of soil, preferably sand or soil that will not adhere to the seed. In the West and South the seeds are put in from November to January. In the East the seeds are put in before the ground freezes in the autumn, in a well drained location. Water standing on the bed will rot the seed. The seeds swell in the seed beds, cracking the shells and the sprouts start as the weather warms in the spring. As soon as the sprouts appear the seeds are planted three to four inches apart in furrows in nursery.

Planters are now made that plant large seeds like peaches and plums in furrows.

The seed may be stratified for several weeks in advance of planting, so the seed may be tested by splitting the shell and examining the kernel to see what percentage are plump. The

plump seed can be depended on to grow, so the machine may be set to drop the seeds accordingly, close together or widely spaced, as the germination percentage is good or poor.

French apple seed comes packed in powdered charcoal. It is either sieved or put through a farming mill to remove the charcoal, put in bags and soaked for about a week, changing the water every other day. It is then stored in a cool, moist place until wanted for planting. The soaking makes the seed start more quickly and more regularly.

Before planting, the seed is spread out to partially dry so it will work through the seed drills without adhering. Eight to twelve seeds are planted to each foot of row, three-quarters of an inch deep, the rows ridged up three inches high and the rows two feet apart.

Large seeds, peaches, apricots, plums and many of the nuts treated in this manner, can easily be replanted in the spring. Those that do not sprout can be discarded. There will then be few gaps or missing trees in the rows.

Apple and pear seeds start early and should be replanted promptly. Or, they may be given a covering of soil, the soil kept moist and shaded, allowing them to grow until a second pair of leaves is developed, they may then be transplanted in nursery rows.

Hard shells may be cracked to hasten germination, but it must be done skillfully, otherwise the seed will not germinate. The shell should be cracked only just enough to permit moisture to enter, so the kernel may swell. It is almost impossible to crack the shells safely with a hammer. Use a small vise; turn it up slowly, giving only sufficient pressure to very lightly crack the shell.

Use Fresh Seeds.—Be careful to use only fresh seeds of the current year's growth. Open the seeds and examine with a

magnifying glass, and see if few wrinkles show in the surface and if the embryo is fresh.

Setting Seedlings and Grafts.—The roots of seedlings for stock, are cut back sufficiently to leave six inches under ground. Furrows are opened with a plow designed for that purpose.

The plants are set about six inches apart in the furrows, the soil drawn in with a hoe and firmly pressed about the roots.

A cultivator follows with blades set for drawing the soil up about the plants and this is followed by a firmer made especially for packing the soil firmly about the plants.

In small plantings the furrow is made with a hoe or spade and the plants covered with a hoe and firmed with the feet.

Cultivation.—As soon as growth starts in the spring, cultivation should commence, to conserve moisture and to prevent weeds from getting a start. Where ridges are left over seed rows, these should be carefully leveled with rake or hoe. Keep the soil constantly stirred and the field clean from weeds. Cultivating will be needed once a week.

Artificial watering should be resorted to in dry seasons so the plants will not receive a check in growth.

Spraying.—Insects will begin their work promptly on the young plants and spraying will be needed to keep them in check and to control disease. Bordeaux mixture will likely be needed, possibly with nicotine sulphate for aphids, or Bordeaux-lead with nicotine. Spray for seedlings is used at same strength as for old trees.

Season's Growth.—If the soil is fertile, proper cultivation and spraying given, seedlings will make a growth of from two to three feet the first season and will be ready to graft or bud.

Digging Seedlings.—If the seedlings have made good growth, they are dug late in the autumn. If only poor growth has been made, the largest may be pulled when the ground is soft from autumn rains, the smaller sizes left to grow another year. When dug in the autumn they are heeled in closely, so the leaves will fall.

A small tree digger is used where there are many seedlings to handle, cutting down nearly eighteen inches. Pullers follow closely, pulling, bunching and tying. The plants are almost immediately buried, laid horizontally, leaves and all, in trenches previously prepared. The seedlings are not allowed to be exposed to sun and wind, after the digger has gone through the row.

In about two weeks after burying the leaves will drop off and they are then carted to the cellar for grading, set upright, wet down and covered with soil, until only the tops are exposed, a layer of leaves put over the exposed tops, where they are left for any remaining leaves to drop.

If the weather turns warm the seedlings may burn. Plenty of soil between the layers is the only preventative.

The seedlings or stocks are then assorted according to sizes and bunched.

Extra size.....thicker than a lead pencil

No. 1.....somewhat smaller

“ 2.....for collar grafting with
small cions and for bud-
ding

“ 3.....for transplanting

The seedlings are packed in moist moss or sawdust and stored in a cellar, where they will be ready for use as wanted. For shipping, the tops are cut off near the collar.

Good stocks are grown on a large scale in the Middle West and are used by many nurserymen in preference to growing their own.

WHEELBARROW COMPRESSED AIR SPRAYER



Chapter XX

CARE OF YOUNG NURSERY STOCK

The time required to produce a salable tree from a bud or graft depends on the kind of tree and variety, the soil in which it is grown, the length of the growing season in the climate where it is grown and the care it is given. Two years will be necessary for most kinds.

Cultivation.—Young nursery stock requires frequent and clean cultivation. The best operated nurseries are practically free from weeds, insects and plant diseases. The weeds are kept down by frequent cultivation and insects and diseases by spraying. The cultivating conserves moisture for the use of the plant roots. More than this, frequently stirring the soil has a beneficial effect, not wholly understood at the present time. The trees should make an unchecked healthy growth throughout the season. If a period of protracted drought occurs in the late summer and growth is checked, the trees may form terminal buds, preparatory to a dormant condition. If this is followed by heavy rains, a weak growth is likely to start and this is likely to cause winter injury.

Some trees, especially fruits such as peaches and cherries, may under ordinary conditions, or where too liberally fertilized, particularly where too much nitrogen has been supplied or supplied late in the season, make growth so late in the season that the wood will not be sufficiently hardened to stand winter conditions.

Heading back is the process used on young stock that has made growth so late as to be likely to sustain winter injury. The tips are pruned off which gives a uniform size to the stock and favors the development of a strong trunk. Apples and pears, called pome fruits, seldom require this treatment.

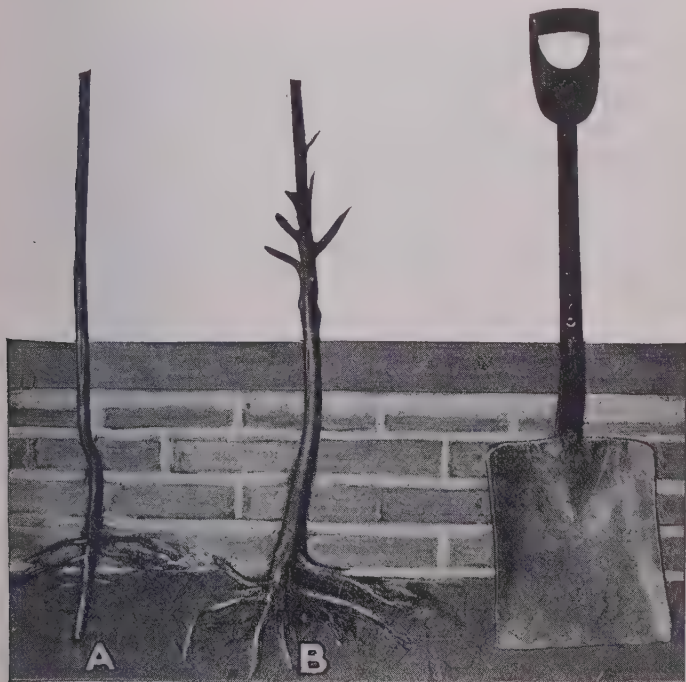


NURSERY STOCK—DIFFERENT GRADES OF 1 YEAR OLD PEACH TREES

A—3 to 4 foot grade; B—4 to 5 foot grade; C—5 to 7 foot grade.—U. S.D. A.

Trimming.—The branches of young fruit trees and some deciduous ornamental trees are removed in the autumn about eighteen inches above the crown, that is, the place where the union of the bud or graft joins the root stock.

Young trees, of necessity, are grown close together in nursery rows. This saves space and has the advantage of producing long, straight stems or trunks which purchasers are justified in demanding.



NURSERY STOCK—PEACH TREES TRIMMED READY TO PLANT
A—4 to 5 foot grade; B—5 to 7 foot grade.—U. S. D. A.

Spraying, which has been referred to as practiced in well managed nurseries, is required to keep the stock free from insects and diseases. Nurseries are inspected in most states and a certificate is required from state authorities showing the stock to be clean, before it can be shipped.

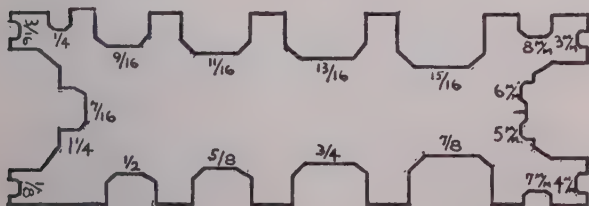
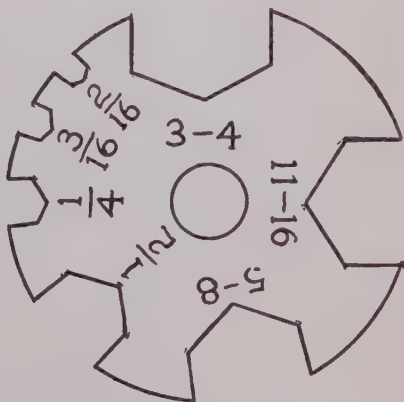
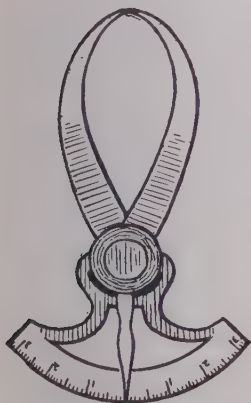
Manufacturers of sprayers make various types of sprayers for hand use, and also horse drawn or tractor types for work over large fields.

Inventory or count of stock should be taken and carefully kept before the trees are dug. Dead and poor stock should be destroyed. An estimate of the grades is made at counting time. This is necessary so the grower may know what stock he has to sell of each different grade. The count is carefully kept. When orders are received a record of these is also carefully kept so the nurseryman knows at all times just what stock still remains to be sold. If over-sold, an effort may be made to purchase good stock at prices which will permit filling orders at a profit.

Loading.—When the trees are pulled they are examined to see that the roots are in good condition. Defective trees are discarded and good specimens laid in piles of a few trees each, as the pullers work along the rows. The piles are thrown on platform wagons, having no sides, the roots placed along the outside edges and the top toward the center piling them high. The piler on the wagon wears rubber boots or shoes with rubber soles, so as not to spoil the trees by breaking the bark.

Fumigation in some states is required by law. The wagons when loaded and on the way to the storage sheds are taken into an air-tight building, made for the purpose, the horses and men removed and a half-hour treatment of the deadly hydrocyanic gas administered, which destroys all animal life.

Storage House.—Where quantities of trees are grown they are placed in specially constructed storage sheds. These are low, frost proof buildings. Where the weather is too severe to make the buildings frost proof, fires may be required at times to prevent freezing. The floors are generally earth, which has been leveled. Compartments are made for keeping varieties separate.



TREE CALIPERS

The trees are placed in their proper compartments, piled high to make the most of the space, the roots facing the passage ways between the compartments. The roots are covered with damp moss or any material that will prevent their becoming dry. The hose is used to prevent drying and the stock must be frequently examined to see that it does not become dry.

Where the climate is moderate, nursery stock is heeled in, in the open ground, but this is not practical in the severe winters of the North.

This system permits the grading and labelling to be done in the winter when there is little or no work in the fields. As the trees are graded and labelled they are again packed away in stalls from which the orders are filled at shipping time. The trees are examined in handling and any poor or damaged stock is discarded. Bundles of twenty-five are tied together, which saves compartment space and simplifies the filling of orders.

Tree Grades.—Fruit trees are graded into four sizes as follows:

Two year old

1 or	X2	5 to 6 feet
2 “	XX2	4 “ 5 “
3 “	XXX2	3 “ 4 “

One year old

4 or	XXXX1	3 to 4 feet
------	-------	-------------

Inspection Laws.—In every state there is a law for the inspection of nursery stock. Nurserymen are required to file applications for inspection of their stock with proper state officials. The information may be had from the Commissioner of Agriculture at the State Capitol.

Every package must contain a certificate of inspection. The inspection of the nursery is made once or twice a year in most states, but the laws vary in different states and are changed from time to time.

In addition, we now have a Federal Horticultural Board at Washington, D. C.

Shipping Plants and Cuttings.—As has previously been explained, plants require air, stem and root. Plants packed moist in air tight boxes may be asphyxiated or smothered or may rot. Live plants will live for quite a time without light, if they have air and moisture.

Plants are shipped by knocking them out of the pots while the soil is damp, and the ball of earth and roots wrapped in water-proof paper tied above the ball. Others gently shake off some of the soil and wrap the roots in damp sphagnum moss and enclose in water-proof paper. They are packed upright, tightly with damp moss between them in wooden boxes, the boxes being high enough to protect the plants. Some kinds of plants, for short distances, can be packed flat in the boxes. They are conspicuously marked "Live Plants." If shipped in cold weather, "Keep From Frost" is added. In warm weather, "Keep Cool." "This Side Up, With Care."

Specimen plants wanted for decorative purposes are shipped in their pots, after being watered well. The pots are set on end surrounded by excelsior and held in place by slats nailed across the tops of the pots.

Plants that are received in a dry condition should be soaked, root and branch, before planting. Always pack plants snugly so they will not change their position in the box, however roughly handled.

Views Showing Proper Method of Fastening Guy Chains and Bolts and Improper Method of Attaching Wires



Fig. 1—Limbs of an elm guyed by several independent chains 15 feet above the crotches.

Fig. 2—A split crotch that has been guyed by means of a long bolt about 18 inches above the crotch.

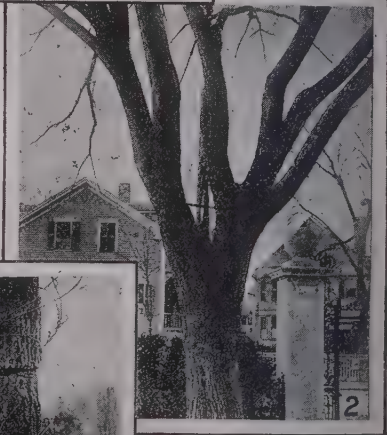


Fig. 3—A tupelo tree nearly strangled by telegraph wires wrapped around the trunk.—U. S. D. A.

Chapter XXI

TREE SURGERY

Trees are subject to injuries of various kinds, caused by the elements, by careless persons and animals. These injuries are often neglected and allowed to remain for years and finally serious trouble results, perhaps a large decayed area.

Tree surgery or tree repair work is a comparatively simple matter, the basis of successful work being common sense.

The principal operation consists in removing all decayed, diseased or injured wood or bark. On small limbs this can often best be done by removing the limb. On large limbs or on the trunk it may mean the digging out of a cavity. All cut surfaces must be sterilized and waterproofed, and the work left in the most favorable condition for rapid healing. The work should be watched from year to year and any defects corrected promptly.

Tree surgery can be done successfully by any man who has a good general knowledge of the growth of trees, the normal manner of covering wounds and how insects and decay organisms cause damage; provided, also, that he can handle tools.

Dead and Diseased Branches.—For removing branches a good sized saw with teeth set to make a wide cut, a gouge, chisel, mallet and knife of good strong pattern are needed. Ropes and ladders will be needed including a step ladder and other tools which will be mentioned later.

Cavities.—In treating cavities remove all decayed and diseased matter. Sterilize and waterproof all cut surfaces. Fill the cavity in a manner that will favor rapid healing and exclude rot-producing organisms.

The tools for treating cavities consist of two, outside-ground socket-handled gouges, one with a curved cutting edge of about $\frac{3}{4}$ inch, the other $1\frac{1}{2}$ inches, chisel, mallet, strong knife and an oil-stone. On large jobs, a small grindstone will save time. Gouges and chisel should never be used near the cambium except when sharp. Dull tools cause injury. For deep cavities, longer, interchangeable handles will be needed for the gouges.

Excavating.—Usually an old and decayed spot may be partially or wholly covered by a new growth of wood and bark at the edges, and the visible decayed area may be small compared with that which is hidden. In such cases it is usually necessary to enlarge the opening with the gouges and mallet, to make room to use the gouges in the interior. The opening should be made as narrow as possible, but it may be sufficiently long to reach all the decayed or diseased heartwood with little or no injury to the tree.

All diseased, rotten, insect-laden, water-soaked or discolored wood must be removed on all sides of the cavity until sound, uninfected wood is reached. It is in this region in which the rot-producing fungus is most active.

Where the decayed areas are of many years' standing, there may be only a thin shell of uninfected wood around the cavity, in which case there is danger of the tree being broken by storms unless stayed or guyed.

Drainage.—The bottom and all other parts of the cavity should be so shaped that if water were thrown into the cavity, it would promptly run out and none remain in any hollow. It is bad practice to have a deep water pocket at the bottom of a cavity, with drainage through an auger hole bored from the exterior. An open hole of this kind is a favorable lodging place for insects and fungus spores.

Undercutting.—In shaping the cavity, the sides should be undercut so as to hold the filling firmly in place. The wood at the edges of the opening should not be very thin, as this will permit the drying out of the bark and sapwood.

Inrolled bark at the edges of an opening should be cut back, as a rule, to a point which will permit the surface of the completed filling to conform with and continue across the cavity in the general contour of the woody part of the trunk. If not possible to undercut sufficiently to hold the filling securely, “nailing” is resorted to, as described.

Great care must be exercised in working around the cambium and all cutting tools must be kept very sharp. The final cutting along the edges of the bark and sapwood is generally best done with a very sharp knife. This cutting should be immediately followed by a coating of shellac, covering the edges of both the bark and sapwood.

Bolting.—Before filling a long cavity it may be advisable to place through it one or more steel machine bolts, so as to hold the wood and filling firmly in place. A cavity two feet or less in length will not usually require a bolt, but longer cavities may need bolting every eighteen to twenty-four inches.

PROPERLY TREATED INJURIES SHOWING NORMAL
HEALING AND UNTREATED INJURIES SHOWING
NORMAL PROGRESS OF DECAY

(See illustration on opposite page)

Fig. 1—Cross section of a tree trunk showing location of parts: a, heartwood; b, sapwood; c, cambium; d, bark; e, corky outer bark.

Fig. 2—A scar beginning to heal over. Note that it heals more rapidly at the sides than at the top and bottom.

Fig. 3—A scar about three-quarters healed over.

Fig. 4—Cross section of a seven year old blaze on a quaking aspen which has almost healed over. Note the large area of decay that originated at the ax cut. The line on the wood indicates the proper shape of the cavity if it were to be excavated.

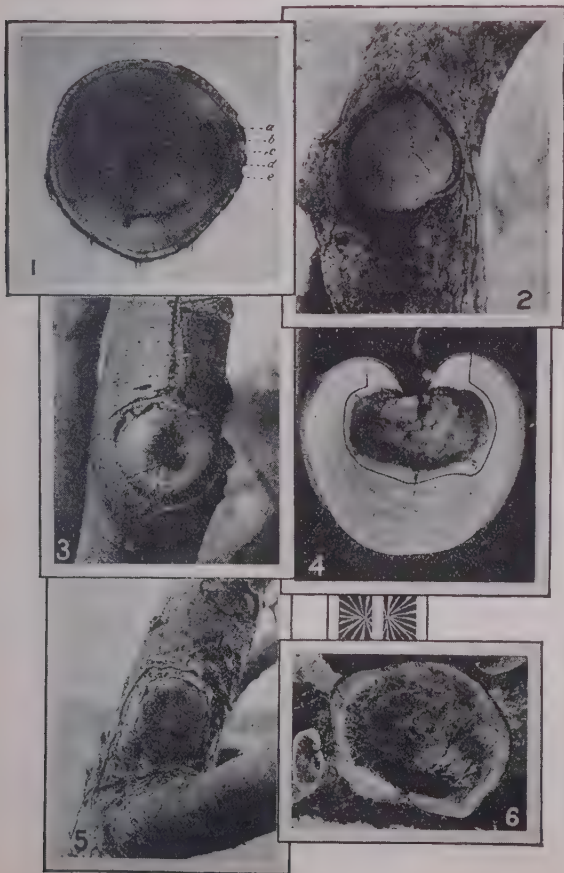
Fig. 5—A scar from a cut limb entirely healed over.

Fig. 6—End of a log, showing a small opening into the large decayed area. Only a shell of sound wood remains.

—U. S. D. A.

PROPERLY TREATED INJURIES SHOWING NORMAL
HEALING AND UNTREATED INJURIES SHOWING
NORMAL PROGRESS OF DECAY

(See description of illustrations on opposite page)



DETAILED VIEW OF EXCAVATED BOLTED AND CEMENTED CAVITIES

(See illustrations on opposite page)

Fig. 1—Cross section of a young tree trunk showing how the new wood and bark grow into an unfilled cavity from the margin. The line on the wood indicates the amount of excavating that would be needed before filling the cavity.

Fig. 2—Cross section of a cavity in a trunk, showing the manner of using a single headed bolt and of placing nails when there is no undercutting.

Fig. 3—Cross section of a tree showing manner of using two single headed bolts to brace a cavity.

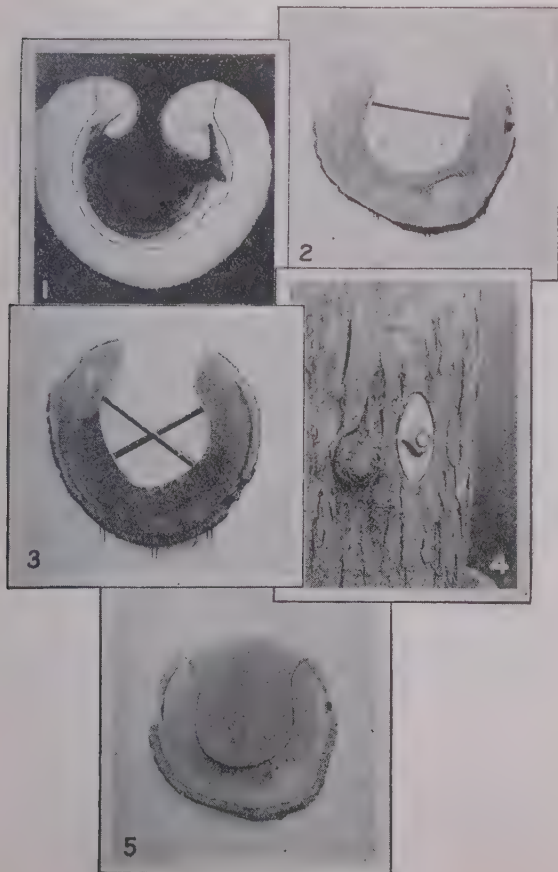
Fig. 4—The oval washer (the best kind to use) showing the proper methods of counter sinking and bolting. (Compare also figs. 2 and 3.)

Fig. 5—Cross section of the tree trunk shown in fig. 2, after it is filled with cement. Note that the surface of the cement conforms to the general shape of the woody portion of the trunk and reaches only to the cambium.

—U. S. D. A.

DETAILED VIEW OF EXCAVATED BOLTED AND CEMENTED CAVITIES

(See description of illustrations on opposite page)



CEMENT CAVITY FILLINGS

Showing different types and successive stages

(See illustrations on opposite page)

Fig. 1—A large cavity in an elm filled with cement blocks separated by layers of tarred paper.

Fig. 2—An excavated cavity ready for treating and filling.

Fig. 3—The cavity shown in Fig. 2 nailed and partly filled with cement. The ends of the rods for reinforcing the concrete are sprung into shallow holes in the wood. The wire dam is sometimes allowed to remain embedded in the cement, although it is usually removed as soon as the cement has partially set.

Figs 4—A later stage of the work shown in Fig. 3. The height of the wire dam has been increased.

Fig. 5—The same cavity shown in Figs. 2, 3 and 4, several days after the filling was completed.

—U. S. D. A.

CEMENT CAVITY FILLINGS

Showing different types and successive stages
(See description of illustrations on opposite page)



TREE SURGERY PROBLEMS

Damaged Cement Filling—Uncemented Cavities—Guy Chains

(See illustrations on opposite page)

Figs 1—A cement filling badly shattered by cold weather and swaying of the tree.

Fig. 2—Cross section of a tree trunk, showing method of covering cavities with sheet metal.

Fig. 3—Section of a tree trunk, showing a simple method of attaching a guy chain to a hook bolt.

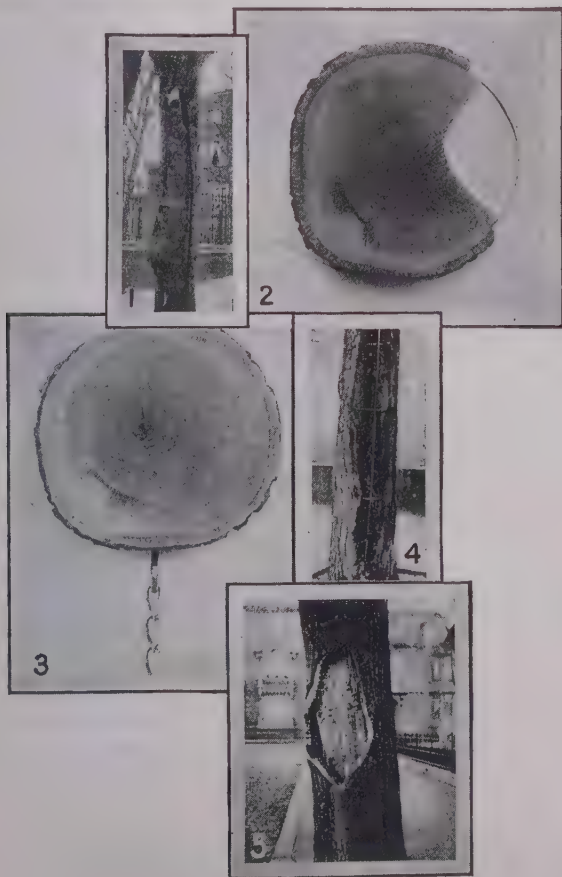
Fig. 4—A long cavity with nails and cement reinforcing rods in place ready for filling. This cavity should have been bolted.

Fig. 5—An open shallow cavity ready for creosote and tar. Shallow cavities of this type are not usually filled with cement.

—U. S. D. A.

TREE SURGERY PROBLEMS

Damaged cement filling—Uncemented cavities—Guy Chains
(See description of illustrations on opposite page)



Often a single bolt is used so as to support both sides, as in figure 2 on page 173. In some cavities it may be necessary to place the bolts at different angles, see illustration. A strip of uninjured cambium an inch wide should be left between the edge of the cavity and the bolt. On medium sized trunks, after deciding the most efficient place to place the bolts, a very sharp half-inch bit, long enough to reach through the trunk and the cavity, should be used to bore the hole for the bolt. On larger, heavier trunks, requiring larger bolts, a larger bit should be used.

Heavy iron washers, round or oval, about three times the diameter of the bolt, should be countersunk into the wood by carefully cutting away the bark at both ends of the hole with a sharp knife or chisel.

The bolt must fit snugly in the hole and project for at least three-quarters of an inch beyond each washer. The thread on the bolt, at each end, should be long enough to permit drawing in the sides of the cavity a little, when the nuts are screwed up against the washers. A single headed bolt may be used. The countersunk cuts and bolt holes should be tarred or creosoted before the bolts are finally put in place and all exposed parts of the bolts and nuts should be tarred.

All split cavities must be securely bolted, particularly near the upper part. If the split comes from a crotch, all decayed and diseased wood should be removed from the split and creosote and tar applied, after which it may be bolted just beneath the crotch, drawing the parts together, back to their normal position. In recent splits, washing with creosote only will be sufficient before drawing the parts together with bolts.

In very large trees, in some cases, a rope and tackle block may be needed to pull the limbs together, to close the crack

before bolting. An abundance of bagging or padding must be used between the rope and bark of the limbs so as to prevent any damage. All exposed edges of the crack should then be covered with tar. Limbs above split crotches may be guyed. If there is a cavity in the crotch, the limbs above it must be guyed before the cavity is filled.

Nailing.—In cavities having large openings, or little or no undercutting, wire nails are driven into the wood in the interior to hold the cement in place. In medium sized cavities nails $2\frac{1}{2}$ to 3 inches long are driven into the wood for about half their length.

Treating.—When the decayed and diseased matter has been completely excavated and the edges of the sapwood and bark shellaced, the interior of the cavity is sterilized so that disease germs and decay will be killed. Creosote is one of the best preparations to use, covering every cut part of bark and wood. Over this a heavy coating of tar or hot asphalt should be applied before the cavity is filled.

Filling Material for Tree Cavities.—Cement is too rigid for use in swaying trees. If put in in sections, the sections grind on each other by the motion of the trees. Dry sawdust and asphaltum has been successfully used by City Forester John Boddy, Cleveland, Ohio.

In swaying branches use one part asphaltum to three or four parts of sawdust. In using this preparation the tools should be moistened with crude oil.

For trunk cavities, one part asphaltum to five or six parts of sawdust. Stir the sawdust into hot melted asphaltum,

making the compound of desired density. The sawdust should be carefully distributed evenly over the surface of the heated asphalt, to prevent boiling over. Apply while hot. The surface can be coated with liquid asphaltum.

Large cavities with a wide exposed surface may require wire screen to hold the material in place. To keep the outer surface of the filling smooth, oil coated wood or metal may be used which will take the pressure when the filling is put in place.

The solid asphaltum used for the purpose is derived from the refining of petroleum with asphaltum base.

Cement.—Where it is desired to use cement, use a good grade of Portland cement and clean, sharp sand, one part sand to 3 or less of cement. A quantity of dry cement and sand sufficient to fill the cavity should be thoroughly mixed before adding sufficient water to make a stiff mortar; the whole mixture worked to an even consistency in a mortar bin; wheelbarrow; pail or any other sufficiently large receptacle.

Cementing.—The mixture of cement is placed in the cavity with a mason's flat trowel and an ordinary garden trowel with a curved blade: Tamping sticks an inch or two thick and of two or three sizes are desirable; one to three feet long:

A layer of cement two to three inches deep is laid in the bottom and tamped firmly:

The operation is then repeated until the cement is eight to twelve inches deep. Wet stones may be embedded in the cement providing they do not reach within about two inches of its outer face. If the mixture is too wet, it will tend to run out of the cavity when tamped. If too dry, it will not pack properly when tamped.

The top of the eight to twelve inch block of cement is smoothed with the flat trowel so it will slant slightly downward from back to front, to facilitate drainage. Over the top of this cement block a double sheet of tarred roofing paper is placed after it has been cut to fit the cavity. As soon as the first block of cement is sufficiently dry to stand the weight and tamping, another cement block is built up on it.

If the interior of the cavity extends well above the level of the external opening, it may be necessary to bore or cut a downward, slanting hole from the outside to the top of the interior cavity, through which a mixture of cement may be poured to fill the upper part of the cavity and hole. The main opening of the cavity must be completely closed, so the thinner pouring cement will not run out.

When a block of cement has partially hardened, the outer surface should be smoothed carefully, or cut down to the level of the cambium, with the flat trowel, taking great care not to injure the cambium. This should be looked after before the cement becomes too hard to trim with the trowel, in which case it should be done with a cold chisel and hammer.

It is a good plan to trim back the outer surface of the cement to $\frac{1}{8}$ inch or more below the cambium and then use a layer of strong cement, one part cement to one to two parts sand, to raise it to the level of the cambium, after the filling has partially hardened. The surface of the cement must be wet before the stronger finishing layer is applied.

The thinner mixtures, that is, mixtures containing considerable water, are supposed to set more firmly than dry mixtures. If thinner mixtures than those mentioned are used to fill a cavity, a cloth or wire screen dam will have to be used to hold the cement in place until it hardens. If the dam covers about a foot of the lower part of the opening, the cavity may then be filled to the top of the dam. The top is smoothed and covered

with tar paper, and the operation repeated. The dam is removed before the cement becomes too hard and the surface finished as above described.

The edges of cement fillings in the crotches of limbs are particularly difficult to keep water-tight. In addition to bolting the cavity and guying the limbs above it, the crevices at the edges of such cement fillings should be made as nearly waterproof as possible, with thick tar or asphalt.

When the cement filling has become thoroughly dry, the face may be painted with coal tar or paint, particularly around the edges where cracks are likely to appear. This should not be done until several weeks after the cement work has been finished.

Cement Work Defects.—Cement is cheap and easily handled in tree repairing. It is inflexible, which is partly overcome by placing the tar paper between the block of cement which allows for slight movement when the trees sway. Large fillings of one piece are almost sure to crack.

During severe winter weather, especially when preceded by a warm period, the wood of an unbolted cavity may draw away from the cement, often leaving a wide crack.

In some instances, by contraction of the wood on a very cold day, the tree may split above or below the filling, or through the cement, where it has not been bolted.

The cement filling forms a surface over which new wood and bark can grow during the growing season and when decayed and diseased matter is removed, further decay is arrested. If the wood draws away from the cement or cracks appear in the cement, or if the work is done improperly, decay may start at the cement edge and make further trouble.

Open Cavities.—Trees which are not of sufficient value to warrant cleaning and filling as directed, may be excavated, sterilized and waterproofed. See illustration. They may be safely left for years in this manner, if the waterproof covering is renewed as soon as blisters or cracks appear. Shallow cavities in valuable trees may be treated in this way. The new wood and bark produced by the cambium will form an inward rolled edge.

Tree Surgery Time.—Tree repair may be done any time when the sap is not running too actively and the weather not cold enough to freeze the cement, if cement is used. Sap in most trees interferes with the work only at the time the buds begin to expand in the spring, until the leaves are full grown. Freezing before it hardens ruins cement. After a week or ten days' drying, frost causes no injury.

A simple method of guying is to place a hook bolt through each limb, with the hooks in the two limbs toward each other and from three to ten feet above the crotch, depending on the size, position and length of the limbs, slipping the end link of a stout chain over one of the hooks. See illustration. At the proper place in the chain to make a sufficiently taut guy, a link is slipped over the other hook.

Three or more limbs can be guyed on one chain, slipping a link over each hook to hold it firmly in its position, one chain connecting all the bolts.

Eyebolts may be used and fastened with heavy galvanized wire instead of chains.

The precautions mentioned under "Bolting" should always be followed, as applied to boring and tarring the hole and countersinking the washers of the bolts.

A turnbuckle rod is better than a chain when the guy is to be kept taut at all times. The rod may be tightened later, if that

is necessary. A turnbuckle can be used with wire in place of a rod.

If the guy is to be placed within a foot or two of the crotch, a single long bolt is generally used (See illustration) where the guyed limbs are not likely to twist much when swayed by the wind.

Never guy limbs of trees by passing wires, chains or ropes tightly around them. Encircling fence wires, clothes lines, telephone or telegraph wires or guy wires will strangle and kill the portion beyond the encircling band.

Climbers.—Climbing spurs should not be used, and if used at all in tree repair work, they should be used as little as possible. Where conditions are favorable, every wound made by a spur may become a new point of decay.

The shoes worn by workmen in tree repair should have soft rubber soles.

Concluding Notes.—Immediately after the final trimming cut is made, the cut edges of the sapwood and cambium should be covered with ordinary orange shellac.

All cut and shellaced surfaces to be painted with commercial creosote followed by thick coal tar.

Sterilizing Tools.—Tools should be frequently sterilized when treating diseased trees, to prevent carrying disease from one tree to another. Wash them in corrosive sublimate, one tablet to a pint of water and wipe the tool dry with a clean cloth that has been boiled in water and dried. Corrosive sublimate is a deadly poison, therefore handle with the greatest care.

This chapter on tree surgery is based on an article by J. Franklin Collins, Forest Pathologist, United States Department of Agriculture.

Chapter XXII

TREE INSECTS AND INSECTICIDES

The best preventative against disease and insect attacks is to keep plants growing vigorously, by giving proper soil, moisture and cultivation. Prevention is better than cure, where that is possible. Study the needs of plants and supply them as nearly as possible.

Rotate crops of annual plants, keep down weeds, burn affected plants and use preventative remedies at the very first indication of trouble.

Plants suffer from poor drainage—too much or too little water—or want of proper fertilizing. The cure for these troubles is to correct them. Diseases are caused by germs or fungi and the spreading of the trouble may be prevented. The affected parts, where possible, should be burned.

Spraying is resorted to, to keep diseases and insects under control.

Kinds of Insects.—Most insects are of two sorts, chewing insects which eat the leaves and sucking insects which puncture the leaf and suck the juices.



Insects on the bark, leaf, bud or flowers are perhaps most generally troublesome. Those that eat the foliage are controlled by poison, sprayed over the foliage. The sucking insects are not usually affected by poison; they pierce the leaf and suck the juices which are free from poison. These insects are killed by contact insecticides which fill their breathing pores.

POISONOUS INSECTICIDES

Poisonous insecticides for the chewing insects, such as caterpillars, cut worms and others include:

Arsenate of lead, used for caterpillars, worms and other insects that eat the foliage. It is used at varying strengths depending on the plant it is used on and the insect it is used for. Three pounds of paste or half the quantity of powder are used to fifty gallons of water. This may be used with Bordeaux mixture, the latter to control fungous diseases.

Paris green is used for the same purposes as arsenate of lead. For potato bugs, 2 pounds are used to 100 gallons of water. Paris green may be used with Bordeaux mixture to control fungous diseases.

Hellebore.—This is largely used for currant worms. The powder may be applied while the dew is on the plants. Mix 1 pound of fresh white hellebore with 5 pounds of air-slaked lime. For wet applications, 4 ounces of hellebore to 2 gallons of water.

Poison Bait.—One-half pound or 1 pound of Paris green to 50 pounds of bran. Mix thoroughly and add sufficient water to make a wet mash. Used to poison cutworms and grasshoppers.

Bisulfid of carbon or Carbon bisulphide may be used for weevils in stored grain. A saucer full is placed in the top of a barrel of peas, beans, or whatever the seed may be and covered tightly. The gas will penetrate to the bottom of the barrel or bin. Also used for root insects—poured in holes in the soil, which are immediately covered up. The gas is very inflammable and must be kept away from fire.

CONTACT INSECTICIDES

Contact Insecticides.—**Tobacco or Nicotine**, most generally used in the form of nicotine sulphate, 40 per cent nicotine. For plant lice or soft-bodied insects it is diluted with from 800 to 1,000 parts of water. Four to five pounds of soap added to each 100 gallons of the liquid will make the spray spread and stick better.

Nicotine sulphate can be combined with either Bordeaux mixture, arsenate of lead, or lime sulphur. Nicotine is a deadly poison.

Emulsions of oil and soap are used for plant lice and scale.

Kerosene emulsion consists of hard, soft or fish oil soap $\frac{1}{2}$ lb., water 1 gal. Dissolve the soap in hot water, stirring until thoroughly dissolved. Remove from fire and while still hot, add kerosene. Pump it back and forth until it becomes a creamy mass. When properly made the oil will not separate on cooling. For plant lice dilute with 10 to 15 parts of water.

Carbolic Acid Emulsion.—Soap 1 lb.; water 1 gal.; crude carbolic acid 1 pint. Dissolve soap in hot water, add the carbolic acid, stir vigorously into an emulsion. For root maggots dilute with 30 parts of water.

FUNGICIDES

Fungicides.—Bordeaux Mixture.—For leaf spot and rust. Shows plainly on the foliage after use. Copper sulphate 4 lbs.; unslaked lime 4 lbs.; water 50 gals. Dissolve the copper sulphate in water at the rate of one pound to one gallon of water, several hours before needed.

Slake the lime, adding water slowly so the lime will crumble into a fine powder. When completely powdered and cooled, add sufficient water to make a solution containing one pound of lime per gallon of water.

These solutions, kept separately, will keep for some time.

When ready to use, measure out the proper quantity of copper sulphate and dilute it with half the quantity of water needed. Measure the lime stock in the same way. After diluting each, mix and use. Commercial Bordeaux can be had to which it is only necessary to add water.

Lime-Sulphur Solution.—Ten pounds stone lime, 10 lbs. flowers of sulphur, water to make 50 gals. Place the lime in a wooden vessel and add sufficient water to start the slaking then add the sulphur and stir vigorously. Add the water and use.

Commercial lime-sulphur can be had, to which it is only necessary to add water. Lime-sulphur is largely used as a winter spray for scale insects and peach-leaf cure and as a summer spray for fruit diseases.

Formalin Solution.—1 pint to 12 gals. water. For sterilizing soil for damping-off fungus. Use $\frac{2}{3}$ gals. for each square foot of surface. Cover for twenty-four hours after treating. Stir soil afterwards and let stand eight days before seeding or twelve days before transplanting.

Miscible Oils.—Miscible means an oil that will mix. There are a number of these now on the market, used chiefly for scale. These oils mix with water and are ready for use. They corrode the sprayers less than lime-sulphur. Use only on dormant trees when the thermometer is above freezing.

SPRAYS

Spraying requirements and spraying seasons differ in various localities. The State Experiment Stations have issued Spraying Bulletins. It is advisable to send to the Experiment Station in the state where the grower resides for the state bulletin and follow the advice it gives.

Apple and Quince Sprays.—Apple sprays are spoken of as the dormant and delayed dormant, etc. This applies also to the quince.

Dormant spray should be made any time two weeks after the leaves drop in the autumn and before the buds open in the spring. Prune trees before spraying to save spray material. Do not spray when it is so cold that the material will freeze on the trees before it dries.

Delayed Dormant Spray.—This application should be made just as the leaf buds are opening and beginning to show green.

Pink Spray.—This application should be made as the cluster buds begin to show pink and before the blossoms open.

Calyx Spray or First Codling Moth Spray.—After the white petals of the flowers have fallen and before the calyces close. Spraying may start when three-quarters of the petals are down, in large orchards, in order to complete the spraying before the calyces close.

Second Colding Moth Spray.—This application should be made three weeks after the calyx or first codling moth spray.

A sixth spray may be needed five to six weeks after the second codling moth spray to control leaf-spot, sooty fungus, flyspeck and the second brood of the codling moth.

A seventh application may be needed a week or two later than the sixth spray, to control tent caterpillars, codling moth, sooty and flyspeck fungus and bitter rot.

Eighth application may be required two weeks after the seventh for bitter rot and blotch and this may require repeating from ten days to two weeks later, according to weather conditions.



BEARING PECAN TREE
Breast high, it is 9 feet 3 inches around
Hartford, Conn.



NORTHERN SPY APPLE TREE
Seven years old.—N. Y. State Col. Ag.

*Chapter XXIII***BEARING AGE****PLANTING DISTANCES**

The age at which fruit trees will bear cannot be accurately tabulated because some varieties of apples, for example, fruit at an earlier age than others and this is true also of other fruits. Varying conditions such as soil, climate and the care that the trees receive, also affect the age of bearing.

The following table is based upon averages:

AVERAGE AGE OF BEARING OF VARIOUS FRUITS

	Age of Bearing	Number per Acre
Apples, Standard	3 to 6 years	35
Apples, Dwarf	2 "	435
Apricots	3 "	193
	2 " Field	7,260

Blackberries.....	1	“	907
Cherries.....	3 to 4	“ Sour	193
Cherries.....		Sweet	108
Currants.....	2	“	2,722
Gooseberries.....	2	“	2,722
Grapes.....	2	“	680
Peaches.....	2	“	193
Pears, Standard.....	3 to 4	“	108
Pears, Dwarf.....	2	“	435
Plums.....	3 to 4	“	108
Quinces.....	4 “ 5	“	435
Raspberries.....	1	“	1,815
Strawberries.....	1	“ Field	10,890

ORANGE TREES AS PLANTED IN CALIFORNIA

Distance Apart in Feet

Tangerines and Dwarfs.....	10 to 12
Half-dwarfs.....	24 “ 30
Seedlings.....	30 “ 40
St. Michael.....	18 “ 24
Mediterranean, Valencia and	
Maltese Blood.....	24 “ 30

PLANTING DISTANCES FOR FRUIT

Distance Apart
Each Way in Feet

Apples, Standard.....	30 to 40
Apples, dwarf, Paradise stock..	8 " 10
Apricots.....	16 " 20
Cherries.....	16 " 25
Figs.....	20 " 25
Loquats.....	15 " 25
Mulberries.....	25
Nectarines.....	16 to 20
Peaches.....	16 " 20
Pears, Standard.....	20 " 30
Pears, Dwarf.....	10 " 15
Persimmons, Japanese.....	20 " 25
Plums.....	16 " 20
Quinces.....	8 " 14
Oranges.....	25
Lemons.....	25
Pecans.....	35 to 40
Blackberries.....	5 " 7
Cranberries.....	1
Currants.....	4 to 5
Gooseberries.....	4 " 5
Grapes.....	8 " 12
Raspberries, Red.....	3 " 5
Raspberries, Black.....	3 " 6
Strawberries.....	1 foot apart in rows 3 ft. apart

Number of Plants Per Acre.—To ascertain the number of plants required for any given area, multiply the length of the space by the breadth, which will give the total number of square feet. Then multiply the distance apart that the rows are to be set, by the distance between each plant in the row, to obtain the number of square feet each tree or plant will take. Divide the number of square feet in the given area by the number of square feet each tree will require, and the result is the number of plants for the given area.

Chapter XXIV

APPLES

A suitable climate for apples is one that does not vary more than twenty degrees a day. Along the southern shore of Lake Ontario, New Jersey, Delaware and Maryland the climate is somewhat similar and here apple orchards flourish. There are good orchards in New England where some apples do especially well. Nowhere are such fine Fameuse or Snow apples grown as in certain sections of Vermont. There are apple trees in Rhode Island fully one hundred and fifty years old.

The leading apple producing states are New York, Washington, Virginia, Michigan, California, and Illinois. Practically every state except Florida and South Carolina produces apples in commercial quantities.

Critical Season.—The season of bloom is the critical time for apples. Frost, rains and great variation in temperature are damaging, so also are warm days followed by cold nights.

The object in producing fruits by plants is to perpetuate their kind, in the production of seed. The apple crop depends upon the pollen, which is the male fertilizing agent, falling upon and impregnating the ovary of the flower. The grains of pollen are active on a clear, bright day and are carried mainly by bees and also by other insects and to some extent possibly by the wind. A pollen grain causes the development of each of the seeds in an apple.



OLD APPLE TREE—BEFORE PRUNING

The June Drop.—Unless the flowers have been properly impregnated, apples may form but later will fall or fail to fully develop. This is the cause of the June drop. Insects and disease may also cause apples to drop.

The June drop is nature's own way of pruning or thinning



SAME TREE—AFTER PRUNING
—U. S. D. A.

the crop. A further thinning may be needed if too much fruit has set. This operation is performed after the June drop, in July. If a still further thinning is needed, that is given in August.

Air Drainage.—Hillsides are better than valleys at the foot of hills. Cold air goes down and warm air rises. Frost occurs in valleys while hillsides escape it owing to this “air drainage” as it is called. A hill with a southern slope is warmer than one with a northern slope. The buds on trees on a north slope of a hill will open later than on a south slope and may thus escape late killing frosts.

Varieties.—There are supposed to be more than 6,000 varieties of apples. Some individual kinds are known by as many as thirty names, or more. Standard varieties are listed in the catalogues of nurserymen. Some varieties do better than others in the sections of the country where they are grown. Learn what varieties are generally grown in a location before planting an orchard. For home use the plan should be to have early apples, medium, late and good keepers for winter. Climate and soil affect the shape and color of apples and the flavor somewhat.

Planting.—Spring planting is the general custom, although apples can be planted in the autumn except where the weather is dry and cold, or where one-year-old trees are set.

In planting orchards, first stake the places where the trees are to be set, having the rows perfectly straight. This can be done by sighting along the stakes, one man sighting, the other setting the stakes, or lines can be used. In some large plantings a chain is used. A link is marked where each tree is to be set and the chain stretched across the orchard. When the row is planted the chain is moved to the next row.

Some cultivated orchards are plowed shallowly, not deeper than six inches (only four inches is better), once a year, in the spring, or else a cover crop is turned under in the autumn, being careful not to injure the tree roots.

Pruning.—Low headed trees are generally preferred because they are easier to handle in picking and spraying, and are pruned to produce this result. In addition, low headed trees with the lower limbs only about two feet from the ground, bear fruit much earlier than those with the lower limbs four or five feet high.

Pruning requirements differ somewhat with varieties and localities. Varieties grow differently. Some varieties of apples, like the peach, produce fruit buds on one year old wood, as with the Ben Davis.

A Rhode Island Greening should never have its center cut out.

Winter Injury.—In the North there may be some winter injury. With dry autumns before freezing weather, trouble may be expected if followed by severe winter weather. Late wet autumns may keep the trees growing too late and result in damage. Heavy snows afford a coating that protects tree roots in winter. A heavy cover crop permitted to remain over winter also affords a protecting mulch.

For cold sections the trees should be grafted on native, perfectly hardy stock, such as native crabs or hardy varieties propagated on their own roots.

Sunscald is troublesome in northern New York, New England and in eastern parts of Canada. Warm sunshine on the bark of young trees thaws the frozen tree unevenly. The side that has been exposed to the sun, suffers when the sun goes down and the bark suddenly freezes again.

When planting, leave a limb low and set this facing the South. Slant the tree to the South, so the trunk will be somewhat shaded by the top. The trunks can be protected by wrapping loosely with heavy paper in winter, removing it early in the spring. Tar paper will not do. Anything that will shade

the trees from the sun without damaging the tree will prevent this trouble.

Frozen Apples.—Apples sometimes may be frozen before they are harvested. If the frost has been light, when the sun warms the air, the sap will circulate and thawing be completed and no harm may be done if the fruit has not been touched. Apples picked even when severely chilled will not keep. Frosted apples should not be touched until completely thawed.

LEADING VARIETIES OF APPLES

Apples are grown all over the United States except in a relatively small area in the South, in semi-arid and in mountainous regions. Apples are grown in Canada from the Atlantic to the Pacific Coast.

Baldwin apples lead in production. The Baldwin is a good shipper and keeper. It is good as a dessert or eating apple and cooks well. The Northern Spy might be more generally grown. It has a rich flavor, keeps well, ships well and cooks well. The Rhode Island Greening is a standard, a splendid keeper, cooker and shipper, but not so well liked as a dessert apple as some others. Its color is not so inviting as a red apple. Russets are usually the best keeping apples, but are not popular in many markets. The Tompkins King is an old and popular favorite.

The Winesap is popular wherever offered for sale. It is an attractive red apple and the name perhaps helps sell it. Almost any red apple in retail markets is likely to be labeled "winesap." The York Imperial is an excellent keeping apple of good flavor, largely grown in the orchards of Pennsylvania and Virginia.

Baldwins predominate in the orchards of New York, Southern New England, Michigan and Ontario. They do not do well much farther south. Wealthy does well in good Baldwin regions and in some sections of Iowa, Wisconsin and Minnesota.

Summer Apples—Standard Varieties

Early Harvest.—Medium size, round, light yellow skin, flesh white. Early summer. Tree spreading as it ages. A good early home variety and where there is a market for early fruit. Not a good keeper, nor are any of the early apples.

Red Astrachan.—Large, roundish, crimson. Flesh tender, juicy, sub-acid. Mid-summer. Good bearer.

Sweet Bough.—Large fruit, greenish yellow skin, flesh white, juicy, tender, rich and sweet. Early to midsummer. Good for home and commercially where there are local markets that will take the fruit. Tree spreading and good bearer.

Twenty Ounce.—Large, attractive, greenish yellow, striped and splashed with red. Bears young. Ripens in September and keeps until early winter. One of the most satisfactory early commercial apples.

William's Early Red.—Medium size, dark red, sometimes splashed with yellow. Juicy and sub-acid. Does well in Delaware and the South. August.

Yellow Transparent.—Somewhat resembles Early Harvest. Pale yellow; flesh white, tender, juicy, sub-acid. Hardy and productive.

Autumn Varieties

Alexander.—Good for culinary use. Fruit large, firm, crisp, tender, juicy, mild sub-acid. Skin pale yellow, striped red. Free vigorous and hardy. September. Keeps until November.

Duchess of Oldenburg.—Medium to large. Striped red on yellow. Flesh white, juicy, sharp sub-acid. Trees are of small growth and make good fillers. Bears young. Hardy and abundant bearer. One of the few that will stand the climate of Iowa, Minnesota and other cold locations. August and September.

Fall Pippin.—Very large; yellow. Flesh white, tender, rich, aromatic, juicy. September and October. Tree vigorous and spreading. Does not do well where there are extremes of temperature.

Gravenstein.—Large, yellow shaded and marbled with red. Flesh tender, with aromatic flavor. Autumn, keeping to mid-winter. Trees spreading. Bears young and abundantly.

Maiden's Blush.—Large, round. Skin creamy yellow, flushed red. Ripens in September. Flesh white, tender. Good for table, cooking or market.

Pound Sweet (Pumpkin Sweet).—Large, round, yellow russet. Sweet and rich. October-November. Rapid, upright grower.

Wealthy.—Medium. Red of good quality and good keeper. Bears young. Tree hardy. October to January.

Winter Varieties

American Blush.—Large, round; skin red on yellow. Flesh white, rich aromatic flavor, sub-acid. Vigorous grower and productive. November to January.

Baldwin.—The leading commercial variety for New York, New England, parts of Canada, Ohio and Michigan and east of the Mississippi River. Large, round, red on yellow ground. Flesh yellowish-white, crisp, juicy. Tree upright and spreading. Heavy yielder. In the South and Southwest it matures with the late autumn varieties. Ripens in November and keeps until April. Will keep until May in cold storage.

Belleflower.—Adapted to Northern and Middle States. Good quality. October to February.

Ben Davis.—The most popular variety south of the Baldwin region, including the Virginias, Kentucky, Tennessee, Missouri, Arkansas. In the Ben Davis belt the fruit becomes large and of good color. The trees fruit young and flower late in the season. Trees hardy, healthy and vigorous. Abundant bearer. The skin is tough, yellow or greenish, striped and splashed with red. Flesh whitish, slightly tinged yellow, firm, moderately coarse, juicy. Ships and handles well, but is not of high quality. Keeps unusually well. Season from January to June.

Boiken.—A recent introduction. Hardy and productive. Fruit of good size, skin yellow, tinted red. Flesh white, crisp, tender, juicy, good. Bears young. Season November to February. Keeps until May in cold storage. Bears young and is a reliable cropper.

Cortland is a new variety developed by the New York State Experiment Station. Said to be a cross between McIntosh and Ben Davis, inheriting the good qualities of each. A beautiful red apple, larger than the McIntosh, of better quality, maturing a month later. Keeps late and ships well. The fruit is large. The flesh is white, often with a pinkish tinge, crisp, tender, aromatic, sub-acid. The trees are large, vigorous, upright-spreading, hardy, healthy and productive. Blooms in mid-season. Fruits about three weeks later than McIntosh, bearing at an early age.

Delicious.—Fruit large, dark red; flesh fine grained, crisp and melting, juicy with delightful aroma; of highest quality. Ideal for fancy box trade. A splendid keeper and shipper. The tree is hardy, a vigorous grower and a regular annual bearer and bears at an early age. Season, November to April.

Fameuse.—When grown in the North in favorable locations, this seems to me to be the most delicious of all dessert apples. It is an early winter sort, not keeping long. It is commonly called “Snow” apple, although that name is now applied to McIntosh by some. An excellent apple for box trade. The color is a beautiful crimson. Flesh is snow white, fine grained, crisp, with a spicy aroma. Tree is vigorous, very hardy and bears at an early age and is a reliable cropper. Season, October to December.

Gano is considered an improved Ben Davis, of deeper color. Season, December to March.

Gilliflower, an old variety known as Black Gilliflower. The color is yellowish or greenish, sometimes almost red, in highly colored specimens becoming very dark. On good soil the tree is a vigorous grower and reliable cropper.

Golden Russet.—Large golden yellow; juicy. Keeps until April. Vigorous grower. Desirable for home use late in the season. Excellent for cider. Hardy. Classed as a biennial bearer, but in favorable locations bears annually.

Grimes Golden.—One of the best of the yellow varieties. Good for dessert and cooking. Does not develop in the North as it does in more southern latitudes. Flesh crisp, tender, juicy. Tree hardy and productive and bears at an early age. Season, December to March.

Hubbardston Nonesuch.—Ripens between the early autumn varieties and the late-ripening winter apples. A vigorous grower, bearing early and heavily. In some places bears annually, in others every other year. Fruit large, mottled red and yellow. Flesh yellow, tender and juicy. Season, October to February. A good orchard tree for New York and Pennsylvania.

Jonathan.—A beautiful, brilliant red apple, highly flavored and of excellent quality. Good for fancy holiday trade. A favorite in the Middle West, but does not attain full size in the East. A moderate grower coming into bearing at an early age. Flesh crisp and tender. Tree is long lived. Good keeper and shipper. Season, November to January.

King, Tompkins King or **King of Tompkins County.**—Large, beautiful yellow, mottled and washed with orange red, splashed with bright carmine. Flesh is yellow, crisp, tender and juicy, sub-acid. Tree spreading, vigorous. A regular bearer as the tree attains age. Season, October to January. Tree is hardiest and longest-lived when top-worked upon hardy stock.

Mammoth Black Twig.—Tree is a strong grower, a regular and abundant bearer. Fruit is deep red; highly flavored, sub-acid. Season, December to April.

McIntosh.—Medium sized, dark red fruit. Flesh white, very tender, juicy and of fine flavor. Tree very hardy, bearing young, abundantly and regularly annually, generally, although sometimes biennially. Season, October to January.

Monmouth is a variety grown in New Jersey and may still be had from some of the New Jersey nurseries. It is a variety that might well be grown more largely in some localities. It is also called Monmouth Pippin. The tree is less subject to scald than Greening. A good apple for the home orchard. The tree is hardy and bears at an early age. A reliable cropper. Pale yellow with a red cheek in the sun. Flesh juicy, aromatic and of good flavor. Season, late autumn to mid-winter.

Newton Pippin, also called Albemarle Pippin. Medium to large. Yellow; good flavor and a good keeper. Season, November to May.

Northern Spy.—An old and excellent variety. Large, attractive red fruit, somewhat striped with lighter shades. Flesh is juicy, spicy, tender. An excellent dessert or cooking apple. Ready for use in November and retains its quality until March. Blooms late. A reliable bearer. Tree a rapid, upright, spreading grower.

Northwestern Greening.—Fruit large, green, becoming yellowish green. Flesh yellow, firm, fine grained and of good flavor, sub-acid. Tree requires plenty of room in the orchard. Season, October to March.

Opalescent, when well grown is a large, handsome apple. The color is light, shading to dark crimson. When polished the skin shines like a mirror. Flesh yellowish, tender and good. Season, December to March.

Rhode Island Greening, commonly called Greening.—Unsurpassed as a cooking apple and as a late dessert apple has few equals. An unusually good keeper, keeping best when picked early. Tree does not come into bearing young, but is long-lived, productive. A biennial cropper, and a good yielder. Is standard in domestic and foreign markets. The fruit is large; skin green to yellow; flesh firm, fine-grained, crisp, tender, juicy. Tree large, vigorous, wide spreading. Ripens in December and keeps until April.

Rome Beauty is a large, round apple, mottled and striped in different shades of red. Appearance and size are its valuable points. Ships and handles well. Flesh is firm, crisp and juicy. Blooms late and is a reliable and heavy annual bearer. Adapted to a wide range of soils, elevations and conditions. A strong grower, bearing at a younger age than Baldwin. Ripens in November and keeps until April.

Roxbury Russet.—One of the best keepers and the most popular of the russets. Good size, with a russet brown skin. Flesh is tinged with yellow or greenish; firm, moderately tender and crisp, sub-acid. Bears heavily, biennially. Tree a free grower, spreading, vigorous, hardy. Season, December to May.

Smokehouse.—Fruit medium to large, yellow or greenish mottled with red. Tree is a vigorous grower, healthy, hardy

and a reliable cropper, coming into bearing young. Season, October to March.

Spitzenburg or Esopus Spitzenburg.—Fruit medium to large, yellow, covered with rich red. Flesh yellow, crisp, juicy, highly flavored. Tree healthy but not a strong grower. One of the best for dessert. Season, November to March.

Stark.—Tree is hardy, healthy and a reliable, productive cropper. Fruit uniform, varying in color, red, developing yellow tints later; handles well. Flavor mild, but good for baking. Does well throughout the Baldwin region and in the North, South and West, outside the range of profitable cultivation of the Baldwin. Season, January to May.

Stayman's Winesap thrives almost anywhere and is valuable for the South and Middle West. Fruit medium size. Skin yellowish, striped and splashed with red. Flesh firm, juicy, crisp, somewhat yellow, of good quality and flavor. An annual bearer. A rapid, large grower, bearing well when four or five years old. Does not seem to be at its best in New York. Season, December to May.

Sutton's Beauty.—Medium to large. Striped bright red on yellowish. Flesh tender, juicy, sub-acid and of good quality. Tree vigorous, spreading. Season, November to March.

Tolman Sweet.—Medium size; light yellow. Flesh white, firm, rich and very sweet. Fine for baking. Tree bears at early age, vigorous, hardy and productive. Season, December to April.

Tompkins King.—See King.

Twenty Ounce is one of the most satisfactory of the early winter varieties for commercial planting, where it can be grown. Does particularly well in New York. Good also for home use. Fruit large and attractive; green becoming yellowish with broad stripes and splashes of red. Ships well. Season, from October to January. Tree of medium size. Subject to sunscald and canker on trunk and large limbs. Regular bearer at an early age.

Wagener or Red Winter Apple.—A beautiful winter apple. Fruit medium to large of attractive bright red, with contrasting shades of yellow. Flesh whitish, tinged with yellow, fine grained, crisp, tender, very juicy, aromatic and generally excellent. Tree bears at an early age and is a reliable cropper, yielding heavily biennially or almost annually. It is inclined to overbear and should be thinned to insure fruit of full size. Thinning properly done usually insures annual bearing. Season, November to March.

Wealthy is a very excellent early winter apple. Valuable for cold climates on account of its hardiness. Comes into bearing at early age. Tree medium size. Planted largely as a filler in young commercial orchards, between rows of stronger growing varieties. Fruit large; skin yellow, attractively striped and splashed with red. Flesh whitish, often stained with red, very juicy, crisp, tender. Quality good.

Winesap is quite different from Stayman's Winesap, which is a seedling of Winesap. Color is deep red, with ground or streaks of yellow. Flesh yellowish, firm, crisp with a rich, high flavor. An old and popular variety in all apple growing

sections. Tree vigorous, bearing at an early age and is a remarkably regular cropper. Does not like low or damp locations. Season, December to May.

Winter Banana.—An attractive yellow apple, extensively grown in the West for fancy trade. Is well adapted to all sections of the Middle West, Central Atlantic and New England States, except in extreme northern latitudes. Popular in New York and Pennsylvania. Fruit large, yellow, with pinkish blush. Has banana flavor and aroma. A good dessert apple. Flesh golden yellow; fine grained. Comes into bearing at a very early age and is a reliable cropper. Season, November to April.

Wolf River.—Fruit large, pale greenish-yellow shaded with light and dark red on the sunny side. Flesh white, juicy, pleasant, spicy. Tree vigorous and very hardy. Originated in Wisconsin. An excellent cooking apple. Season, September to December.

Yellow Belleflower.—Fruit yellow with a blush when exposed to the sun. Flesh tender, juicy, sub-acid. This variety originated in New Jersey. The tree is moderately vigorous, forming a spreading head. An abundant bearer.

York Imperial is grown commercially in the Middle Atlantic States and westward. A thrifty grower and a regular bearer at an early age. Fruit medium, skin bright, smooth, yellowish, overlaid or blushed with light red. Flesh yellowish, firm, crisp, tender, juicy. Good shipper. Largely grown in Pennsylvania and Virginia. Season, November to March.

DWARF APPLE TREES

Dwarf apple trees are usually grown on Doucin stock, sometimes called English Paradise. The stocks are produced from layers or suckers of dwarf growing apples. These are semi-dwarf trees, growing about twenty feet high. The smallest dwarf apple trees are produced on Paradise stock and grow only about ten feet high. Dwarf trees should be kept pruned back to keep them dwarfed.

Dwarf trees usually begin bearing at a very early age, often the second year after planting. As they occupy but small space, they are good for homes having little land on which to grow fruit.

The fruit borne on dwarf trees will be as large as fruit from standard trees grown under the same conditions and of the same quality and appearance.

Planting Distance.—Dwarf apple trees are usually planted ten feet apart each way, but can be planted in hedge rows, the trees set as close as four feet apart. Dwarf pears can be planted in the same manner.

Varieties.—Nurserymen offer such dwarf varieties of apples as Cortland, Baldwin, Delicious, McIntosh, Oldenburg, Red Astrachan, Wealthy, Winter Banana and Yellow Transparent. Any variety can be dwarfed by grafting on a slow growing stock.

CRAb APPLES

The Siberian crab apples are beautiful little fruits, from an inch to an inch and a half in diameter, highly colored. They are good ornamental trees and attractive when in blossom or loaded with fruit. The fruit is excellent for preserving and pickling. Crab apple jelly, properly made, is delicious.

Varieties.—The varieties chiefly grown are:

Hyslop.—Large fruit for a crab, dark, rich red with a thick bloom, produced in clusters. Flesh yellowish; fine for cooking or crab cider. Tree hardy, spreading, strong grower and regular and abundant bearer.

Transcendent is probably more largely grown than any other crab. Hardy, yielding heavy crops annually at an early age. The fruit is large, golden yellow with red cheek overspread with bloom. Flesh yellow, crisp, juicy, sub-acid. Fine for cooking and preserving and makes exceptionally fine cider. Highly prized by some as a table or dessert fruit. Tree is a rapid, strong grower.

Whitney.—Fruit is large, glossy green, splashed with carmine. Flesh tender, juicy and mild of pleasant flavor. Tree is handsome, with dark green glossy foliage. Very prolific and regular bearer.

There are many other varieties of crabs. Those described are old and tried sorts, the most generally grown.

FERTILIZING APPLE ORCHARDS

Fertilizing Apple Orchards.—For eastern conditions, good results are obtained by applying fertilizers after the fruit has set. The kind of fertilizer to use will depend upon the character of the soil, and possibly to some extent upon the variety. The kind of fertilizer to use must be learned from carefully experimenting.

In applying any fertilizer, apply it over the area where the roots feed and that is not to any extent near the tree trunk, except in very young trees. The fertilizer applied to a fully matured tree should be placed from two or three paces from the trunk out beyond the spread of the branches, entirely around the tree.

It has been shown by experiments that fertilizers applied to one side only of a tree will benefit the parts of the tree on that side only.

The time to apply fertilizers may depend on the condition of the tree and the character of the soil. Sometimes nitrogen may be needed in a quickly available form, such as calcium nitrate, leunasalpeter, nitrate of soda, or urea, to set the fruit buds. The application of nitrogen possibly may be required two weeks before the blossoms appear, or earlier than that. Sulphate of ammonia is too slow for this purpose.

Because fertilizer has been used, do not make the mistake of trying to harvest too much fruit. If fruit is grown for market, bear in mind that water is necessary for proper development of good sized fruit and it is good sized fruit that is in demand and brings best prices, provided it is well colored. Unless there is ample rain or irrigation, thin the fruit so what remains will develop properly.

Trees heavy with foliage produce fruit without much color. Sun is needed to color the fruit, too much foliage shuts out the sunlight from the fruit.

Nitrogen tends to produce foliage, so it must be applied cautiously, particularly on fruit that requires a long season in developing. Light colored or yellow foliage indicates the need of nitrogen. Too large applications are likely to spoil the good shipping quality of the fruit.

Tilling the Orchard.—No longer are orchards planted and left to take care of themselves, with the exception of pruning now and then. The general practice now is cover crops turned under and clean cultivation. The crop is turned under in the late autumn or early spring, keeping the land clean by cultivating until about the first of August, when a cover crop is put in and allowed to grow until turned under. The cover crop tends to take up surplus moisture which otherwise might cause damage by encouraging late growth of the trees. Turning the cover crop under keeps up the supply of humus in the soil and that is important.

For cover crops, alfalfa, red or alsike clover, rye, oats, and vetch are used, also rape and buckwheat and crimson clover where that can be grown.

There has been considerable discussion as to the value of and advisability of maintaining a sod mulch in orchards. There are orchards that need a sod mulch, but that does not mean all orchards, by any means.

Near Syracuse, New York, is an orchard in sod mulch that ships as fine apples as are to be obtained, operated by Grant Hitchings. The soil in this orchard is naturally moist and the sod is needed, but the conditions here are not the usual conditions.

Chapter XXV

APPLE MARKETING

Apple Market Requirements.—To obtain good prices, apples must be of good size and uniform in size, of good color, clean and well packed. On the Pacific Coast “extra fancy” red apples must show 75 per cent color and “fancy” 40 per cent. A McIntosh or a Baldwin to be graded as “extra fancy” would have to be fully 75 per cent red, and 40 per cent red to be classed as “fancy.”

In picking, care should be taken not to break off any fruit spurs. A poor picker can do considerable damage.

Apples are picked by an upward turn and a slight twist. They should never be pulled. The stem should remain on the apple. Each fruit should be placed in the pail, never dropped in.

For storage purposes apples should be picked just before the fruit is mature. Mature fruit will not keep so well. Fruit to be shipped and sold as soon as picked may be allowed greater maturity.

Ladders.—Tripod ladders are used for low headed trees. In high trees, ladders with narrow or pointed tops are used as they are easiest to handle. In very tall trees, extension ladders may be required. The desirability of low headed trees can be understood at picking and spraying time.



TRIPOD LADDERS

For gathering fruit.—N. Y. State Col. Ag.



PORTABLE LADDER

For use where tree cannot bear weight of ladder and picker

—N. Y. Sta. Col. Ag.

Boxes.—If the fruit is sent to the packing shed to be graded and packed, boxes are used for this purpose. Crates should not be used as the apples will be bruised by the edges of the slats. The boxes should be small enough for convenient handling, somewhere about 14 by 20 inches and 8 or 9 inches deep. A cleat nailed on top of each end to protect the fruit, in case the boxes are piled and a cleat nailed on the top outside of each end or a slot cut in the end for a grip when handling.



A GOOD BASKET PACK

Basket with good ringface.—N. Y. State Col. Ag.

Hauling.—Low, wide, spring wagons with small wheels are used in orchards. The low wheels permit short turns. The fruit should not be allowed to stand in the sun. Cover the boxes with burlap and promptly deliver to the packing shed. The fruit should not be picked or handled when wet.

Barrels.—The Federal law requires a barrel with a capacity of three bushels, branded “Min. Vol. 3 Bus.” There are no nails in barrels as received. The hoop on one end is driven tight and nailed with short nails, $\frac{3}{4}$ inch. If longer nails are used they should be clinched so as not to injure the fruit. The hoops are driven tight and one head nailed and the face end stenciled with variety, packer, size and grade and a corrugated strawboard cap placed in the bottom.

Facing.—A layer of apples is carefully placed so as to be attractive when opened. Each apple put firmly in place without bruising, placed with the stems down, and they should represent the actual quality of the apples in the barrel. A second layer of facers is put in place by careful packers.

Racking.—The barrel is then carefully filled, “racking” the barrel by shaking with a rolling motion to settle the fruit well in place as it is put in.

The top of the barrel is “tailed” by carefully placing the fruit on top with stems up, so the pressure of the head will be uniform on all the apples on top.

The height of the fruit above the top of the barrel before heading varies from half an inch to two inches, depending largely on the thoroughness of the racking. This is necessary to insure a tight pack, but it is not in itself sufficient, without thorough racking.

METHOD OF HANDLING APPLE HARVEST

Fig. 1—Tractor pulling 2 loads of 20 bbls. each. Tractor sometimes pulls 3 loads of apples over steep hills. (Hamburg, Ia.)



Fig. 2 — Loading barreled apples from trucks into refrigerator cars. (Winchester, Va.)



Fig. 3—The three-pole wagon load used in Virginia. (Round Hill Orchard Co.)

CLOSING THE APPLE BARREL

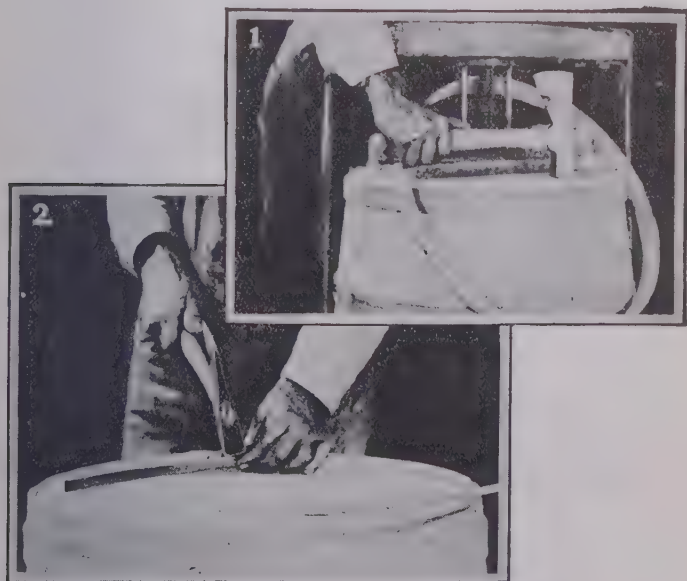
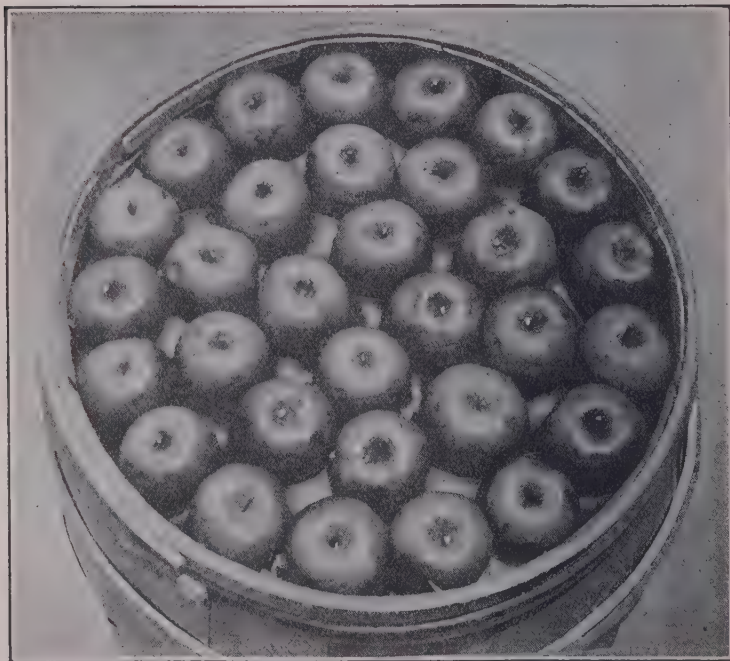


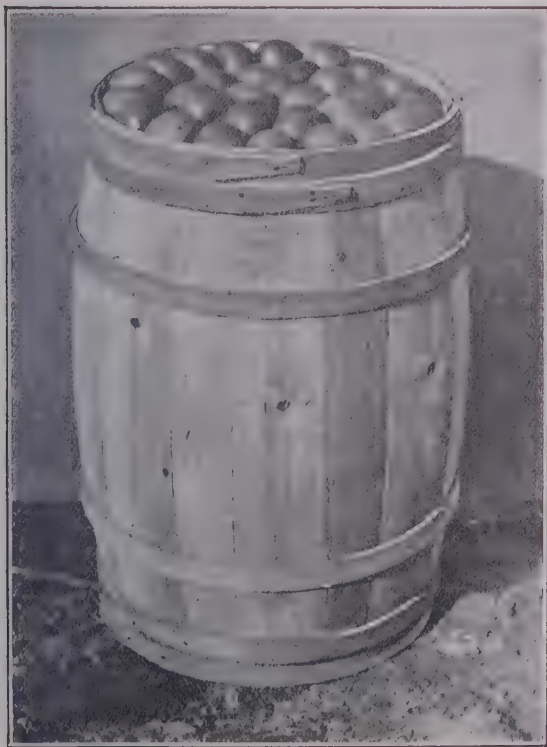
Fig. 1—The screw press used for heading barrels.

Fig. 2—Nailing on the head liners.



TAIL END OF BARREL

Showing a good ringtail.—N. Y. State Col. Ag.



THE BARREL FACE
—N. Y. State Col. Ag.



BARREL PRESS

And Barrel and Basket Follower.—N. Y. State Col. Ag.

Follower.—The use of a follower in leveling the filled barrel, preparatory to pressing in the head, is essential.

The follower is made by sawing out $1\frac{1}{2}$ or 2 inch planks in circular form, somewhat smaller in diameter than the head of the barrel. This should be heavily padded. The follower is used at the last racking to produce an even surface, so that each apple in the tail receives an even pressure as the head is forced into place. Unless the fruit is level on top, any projecting apples above the surface will be seriously bruised by the time the head is in place.

Pressing and Heading.—A screw press is used for heading the filled barrel. A block of wood is placed over the head which is slowly forced down into place. Hydraulic presses which do the work quickly are used in large plants.

The quarter hoop is slackened, the top hoop removed and the second hoop loosened. The head is then forced into place. The second hoop is driven into place, the top hoop replaced and the quarter hoop tightened. A driver of hard wood will be required for this purpose.

The head is nailed firmly with $1\frac{1}{4}$ inch nails and the quarter hoop nailed with $\frac{3}{4}$ inch clout nails.

See that the barrels are kept clean and dry. Dirty or second hand barrels do not appeal to buyers.

Grading and Sizing Machines.—Every box of fancy apples of any grade contains exactly the same number of apples of uniform size. The apples are usually wrapped in paper and put in in layers, the same number in each layer.

Fancy fruit was first packed in this way to permit western growers to compete with fruit grown in the East.

APPLE GRADING

Fig. 1—A Hardie apple sizer or grader. Four men sorting out defective apples. The two men nearest the sizing shafts or screws, also do the feeding. The man at the side of the machine is the packer who fills the barrels. Note the manner in which he holds the bag thus preventing the fruit from dropping and being bruised. (Waynesboro, Va.)

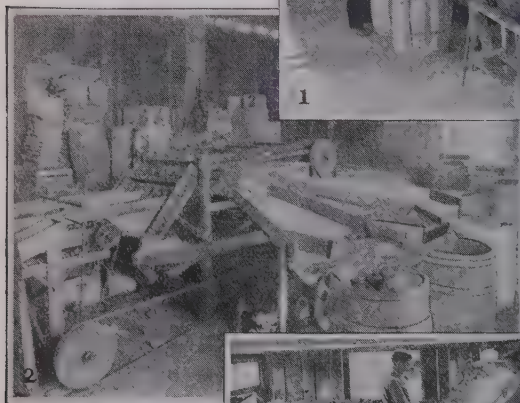


Fig. 2—Close-up view of Pease grading machine showing sizing unit and apples in bins ready to be run into barrels. (Waynesboro, Va.)

Fig. 3—Another view of Hardie grader, showing the apples working through the grader. The three large apples passed clear through being too large to drop through.



PACKING APPLES IN BOXES

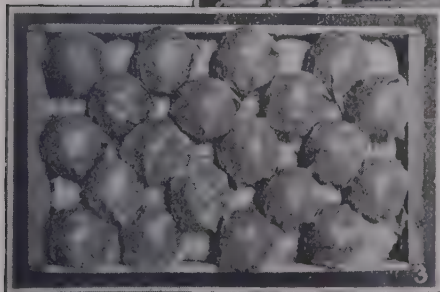
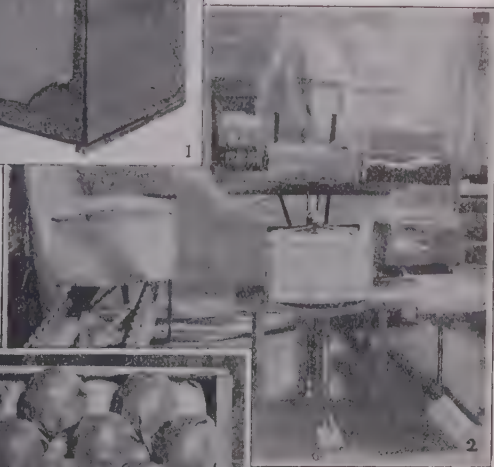
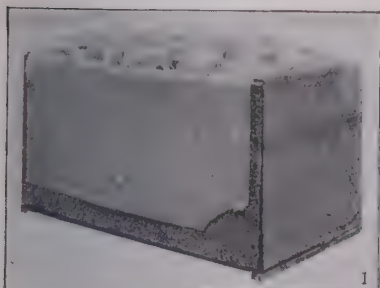


Fig. 1—A packed box of apples showing the proper bulge.

Fig. 2—Lidding press with box in place for nailing. Nail stripper, hatchet, tops and cleats within handy reach for nailer. At right, unlidded box ready for press. At left, a lidded box.

Fig. 3—Diagonal style of pack—3—2 wide, 4 apples long, 5 layers deep. 100 apples in box (Yakima, Wash.).

The boxes containing fruit of a uniform size and a known quantity in each box, so dealers know exactly what their profit on each box will be when the fruit is retailed at a given price. The whole face of the box showing attractive fruit of uniform size is inviting when exposed and makes sales.

In the Central and Eastern States, growers pack apples in barrels, hampers and baskets.

Proper cooperation of Eastern growers would develop a much better market for Eastern fruit. The West has population sufficient to take care of its production. Eastern and Western growers by cooperating can find a good market for their entire production. There are not too many apples produced. There may be insufficient consumption and this can be greatly increased with benefit alike to consumer and producer.

Sizing and Grading.—The choicest fruit is sized and graded by hand. Hand work costs more than machine work. Machine sizing may injure the fruit, but machines are being perfected and this danger is constantly lessened.

Sizing is now necessary as many states require that the minimum size of the fruit be marked on the barrel.

Grade.—The grade is entirely a separate matter from the size. Any size fruit may be Fancy A, B or C. Box fruit is marked Extra Fancy, Fancy or Choice or C.

Grading Machines are so constructed, that, as the apples are emptied from baskets into the machine, they are carried along

and all of certain sizes dropped into containers holding only that size. Imperfect fruit is removed by inspectors, as it passes before them. There are several different types of graders doing good work and graders are being brought out for grading other fruit than apples, including peaches, pears, etc. Grading machines and a packing house can be used economically cooperatively.

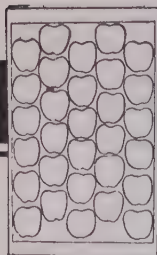
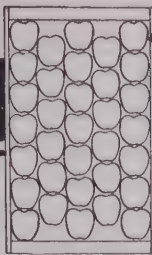
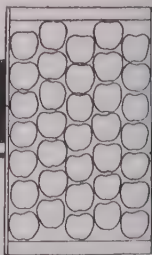
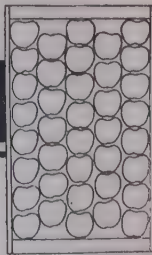
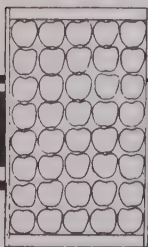
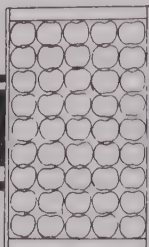
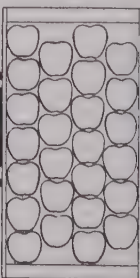
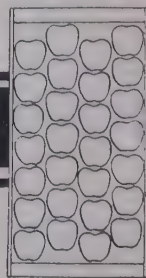
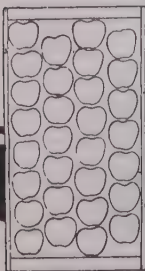
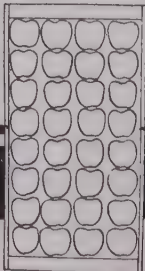
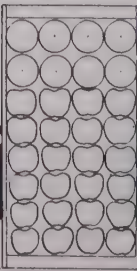
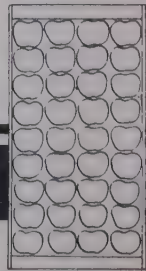
An apple like the Greening will pack about nine hundred to the barrel, 2 inch size; $2\frac{1}{4}$ inch, 750; $2\frac{1}{2}$ inch, 580; $2\frac{3}{4}$ inch, 450; 3 inch, about 315.

Boxing.—The standard apple box is $10\frac{1}{2} \times 11\frac{1}{2} \times 18$ inches, inside measurement. The top and bottom are made of $\frac{3}{16}$ or $\frac{1}{4}$ inch material, each of two pieces and each with two cleats: the sides of one piece $\frac{1}{4}$ to $\frac{3}{8}$ inch stuff and the ends of $\frac{3}{4}$ inch. These are usually shipped to the purchaser “knocked down.” Export boxes must be wired or metal strapped. In nailing, splitting is prevented in the light material by soaking it in water before nailing. Nailing machines are operated where the quantity of boxes used is sufficient to warrant it.

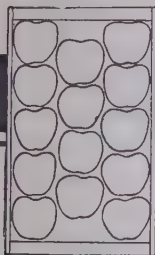
The box is lined with paper, so placed that it will cover the fruit when the box is filled. Each apple is wrapped in paper which prevents bruising and decay spreading. If oiled paper is used, scald will be prevented. The papers are to be had from supply houses and offer opportunity for the grower to print his name and address on them.

The Press.—A box press is necessary to hold down the two ends of the box cover at the same time, holding the cleats in

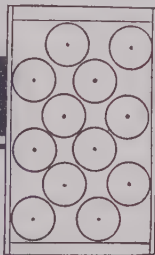
VARIOUS PACKS

150 APPLES
NORTHWEST STANDARD BOX166 APPLES
NORTHWEST STANDARD BOX175 APPLES
NORTHWEST STANDARD BOX100 APPLES
NORTHWEST STANDARD BOX200 APPLES
NORTHWEST STANDARD BOX225 APPLES
NORTHWEST STANDARD BOX134 APPLES
NORTHWEST SPECIAL BOX144 APPLES
NORTHWEST SPECIAL BOX120 APPLES
NORTHWEST SPECIAL BOX138 APPLES
NORTHWEST SPECIAL BOX128 APPLES
NORTHWEST SPECIAL BOX144 APPLES
NORTHWEST SPECIAL BOX

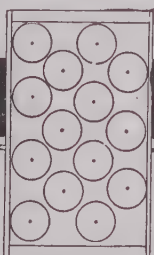
VARIOUS PACKS



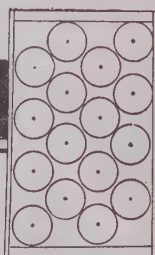
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NORTHWEST STANDARD BOX



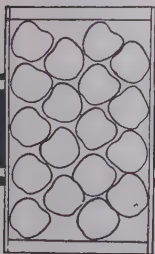
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NORTHWEST STANDARD BOX



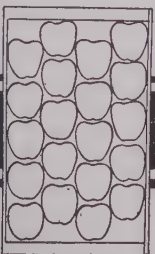
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NORTHWEST STANDARD BOX



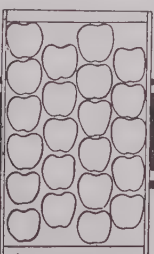
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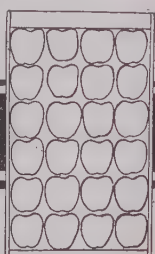
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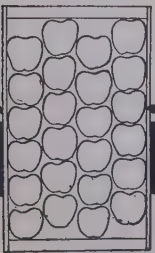
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NORTHWEST STANDARD BOX



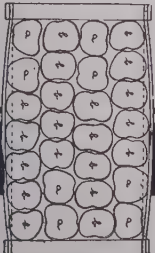
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NORTHWEST STANDARD BOX



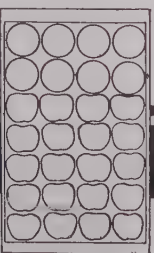
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NORTHWEST STANDARD BOX



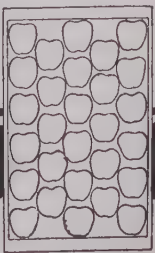
96 APPLES
NORTHWEST STANDARD BOX



112 APPLES
NORTHWEST STANDARD BOX



118 APPLES
NORTHWEST STANDARD BOX



128 APPLES
NORTHWEST STANDARD BOX

position also, until they are nailed. The press must be so constructed that the cleats can be nailed while being held in place by the press. The press is in the form of a table on which the packed box is set, the arms of the press coming down over the cover and cleats when the foot lever is pressed down. A foot lever on which the operator presses holds the cover and cleats in place until nailed. The press can be constructed at home or purchased.

Packing the Box—Packs.—There are only two styles of packs being used to any extent at the present time in the Northwest: these are the straight and diagonal packs. The straight pack includes the three, four, and five tier packs. The rows run parallel to the sides of the box. The diagonal pack contains the $3\frac{1}{2}$ to $4\frac{1}{2}$ tiers. The rows seem to run diagonally across the box. Most apples are packed diagonally. The reasons for this are: First, it is not as hard a pack to put up as the straight; second, the fruit will carry farther and reach the market in a better condition than that of the former.

When everything is ready for packing fill up the packing table with one-sized apples. Never put more than two sizes on, as the apples will have to be sorted over if more than this number of sizes are put on at once. Where two packers are worked at a table two sizes can be handled very readily, as each packer will put up a different sized apple. Always keep the table well filled with fruit; this gives the packer a greater range of specimens to choose from. See that the packers are supplied with well-made, clean packing boxes.

A box is now placed on the box-rest and prepared for receiving the fruit. This is done by taking two sheets of the proper sized

lining paper and placing them in the box so that the ends reach a little past each other in the center. Press down the paper along the edges of the box so that it will not tear when putting in the fruit. Now place a sheet of layer paper over the lining paper in the bottom of the box. The box is now ready for the pack. The object of the lining paper is to protect the fruit from dust and odors that may come through the cracks in the bottom along the sides. Do not, under any circumstances, use dirty boxes or paper. The neatness of the pack goes a long way in securing top prices.

Fill up a paper tray with wrapping paper and hook it on the side of the box, placing the paper so that the smooth side will be up. The object of the smooth side is so that it will slip in the hand readily. Each packer provides himself with a rubber thumb-shell; this is to aid him in picking up the paper. Wrap each apple. As has been explained, the paper forms a cushion which protects the apple from bruising, and also seals the apple in a separate package, protecting it from being damaged by the decay of another specimen in the box.

In packing the first layer, wrap the apple so that the tag ends come over the stem. This forms an extra cushion and prevents the stem from puncturing the apple. Place the stem end down. There is always more surface here for the apple to rest on; also, if there is any bruising, it does not show up in the apple. There is an exception to this rule, however, and that is where the apples are of such a length that they will have to be packed on the side.

After completing the first layer put in another sheet of layer

paper, and if the apples are to be placed on end wrap the specimens so that they will be placed stem up. The remainder of the layers are to be packed as suggested for the second. Press each apple firmly in place, but do not use enough force to bruise the skin.

Bulge.—Unless the pack is put up firmly you will not be able to judge the size of bulge you are getting on the box. There should be at least one-half to three-fourths inch bulge on the box after it is nailed up. This bulge is obtained by using a slight shade larger apple in the center. Make use of the taller specimens for building a bulge by placing them toward the center. This to a certain extent does away with selecting fruit that has a greater diameter than the specimens being used. This, however, applies to the apples that are packed on end. Begin building the bulge with the first layer.

When the pack is completed place a sheet of layer paper over the fruit and then fold over the ends of the lining paper. Now set the package on the nailing press, lay the cover boards in place with a cleat at each end and clamp down firmly, drive four nails in each end of the cover. Remove the package from the press and stamp the number of apples, the tier and the variety on one end.

Label.—The variety is usually stamped in the center near the top, and just above it the number of apples. The tier is put over in the left hand corner, leaving the other end free for the lithograph. If you are shipping them through a union, this will

be placed on at the loading station; otherwise you will have to provide a lithograph of your own design.

In stacking up the box, or in hauling them to the car, place them on the side, never lay a pack of apples on the bulge; the weight is sure to bruise the top and bottom layers of the fruit.

Dozen Boxes.—Grocery stores in the East are now handling strawboard boxes, made with twelve divisions holding a dozen apples. The number of families living in apartment houses is increasing and in these there is no place to store fruit. The buying is therefore more frequent and in small quantities and this box of a dozen apples seems to meet the requirements of purchasers.

Storage houses are described and illustrated in volume 2 of these guides.

The New York State Experiment Station operated an apple orchard near Rochester for many years, mainly Baldwins. A record of the cost of operating was kept when the trees were twenty-seven years old, planted twenty-seven to the acre.

Part of the orchard was in sod and part under tillage. The orchard was valued at \$500 an acre and interest at 5 per cent was figured.

The first five years' spraying was with Bordeaux and arsenate of lime. The last five, lime sulphur and arsenate of lead.

LOADING AND STACKING BARRELS

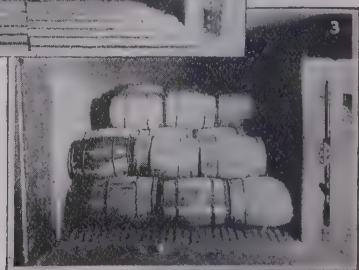
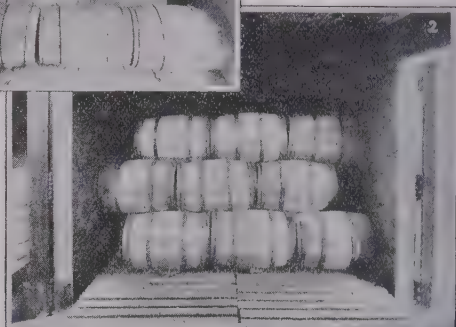
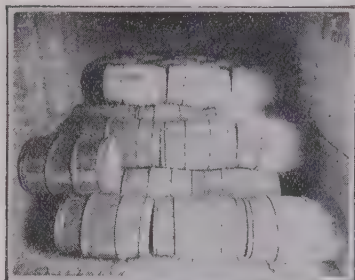


Fig. 1—The staggered method of loading.

Fig. 2—One method of stacking barrels in a car. This is the most common type of loading found in the barreled apple sections. Number of barrels per load varies with the length of car and order of the buyer.

Fig. 3—The alternating, straight method of loading.

AVERAGE YIELD PER TREE 1904-13

Year	Barreled Fruit	Barrels of Culls and Drops	Year	Barreled Fruit	Barrels of Culls and Drops
1904	2.45	2.13	1909	2.37	1.64
1905	1.42	.74	1910	1.92	.69
1906	2.67	1.44	1911	3.41	2.19
1907	2.41	.88	1912	3.86	1.70
1908	4.18	1.41	1913	4.41	1.02
Ten Year Average.....				2.91	1.38

Prices and Returns Per Barrel

Year	Barreled Fruit	Culls and Drops	Year	Barreled Fruit	Culls and Drops
1904	\$1.41	0.26	1909	3.35	1.11
1905	2.80	.66	1910	3.35	1.08
1906	2.00	.34	1911	2.50	1.02
1907	3.50	.79	1912	2.00	.60
1908	2.25	.37	1913	2.00	.97
Ten Year Average.....				2.52	.72

Spraying was done three times each season the first five years and twice the second five years, the dormant spray just before the buds began to swell, the second as the blossoms dropped. Pruning cost \$2.00 per day of ten hours and cost \$3.56 per acre. Hired teams did the cultivating at \$4.00 per day of ten hours and later at \$5, the average being \$4.50.

The land was plowed in the spring, followed by harrowing and rolling an average of seven times a season. The cover crop seed, red clover, cost \$2 74 per acre. Harvesting, packing and hauling were done variously, the fruit hauled a mile and a half to the station. The barrels cost an average of 36 cents each.

The Average Cost for Ten Years, 1904-1913

	Per Acre	Per Tree	Per Barrel
Interest on Investment....	\$25.00	\$0.9274	\$0.21
Taxes	1.50	.0555	.012
Tillage	7.39	.2737	.063
Pruning	3.56	.131	.03
Spraying	11.28	.418	.096
Cover Crop Seed	2.74	.023	.023
Superintendent	30.00	.0110	.25
Picking, Packing, sorting, Hauling and Barrel....	57.26	2.1000	.604
Total	\$138.73	\$3.9396	\$1.288

Average Yield per Tree, 1914-1923

Year	Barreled Fruit	Barrels of Culls and Drops	Year	Barreled Fruit	Barrels of Culls and Drops
1914	5.92	1.78	1919	3.38	0.49
1915	2.67	0.49	1920	1.35	0.63
1916	2.75	1.12	1921	6.30	1.35
1917	2.75	1.10	1922	1.19	0.64
1918	4.16	0.74	1923	4.75	0.85
Ten Year Average.....				3.52	0.92

Price and Return per Barrel

Year	Barreled Fruit	Culls and Drops	Year	Barreled Fruit	Culls and Drops
1914	\$1.17	\$0.33	1919	\$6.60	\$2.20
1915	2.37	.70	1920	4.25	.40
1916	2.00	.60	1921	5.75	1.16
1917	2.00	.60	1922	5.25	.50
1918	3.65	1.00	1923	5.25	.50
Ten Year Average.....				\$3.83	\$0.88

The value of the orchard the second period was figured at \$600.00 per acre making the interest charge \$30 00. Taxes the second period were \$3.00 per acre All the work done was hired so no depreciation was charged against tools or buildings. The cost of tillage in the second period was \$14.40 per acre.

The price of team work was \$5.00 per day of ten hours, while the cost of seed for cover crop was \$7.60 per acre, while the cost of pruning advanced to \$11.03 per acre and spraying \$18.44 per acre.

Average Cost for the 2nd Period of Ten Years

	Per Acre	Per Tree	Per Barrel
Interest on Investment. . .	\$30.00	\$1.11	\$.25
Taxes.	3.00	.111	.025
Tillage.	14.10	.54	.117
Pruning.	11.03	.40	.091
Spraying.	18.44	.68	.153
Cover Crop Seed.	7.60	.28	.063
Superintendent.	30.00	.011	.25
Picking, Packing, Sorting, Hauling and Barreling. .	56.68	2.09	.472
Total.	\$170.85	\$5.222	\$1.421

Net Profit.—The average yearly net profit on a barrel of apples, graded and ungraded, for the period running from 1903 to 1913 was \$1.31 and for the second period was \$1.71. The average for the two periods was \$1.51 per barrel. The average net profit per acre for the first period was \$95.60 and for the second, \$145 83. Calculating the interest on the first period, land valued at \$500.00 per acre returned a dividend of 24 per cent and for the second decade the dividend was 28.5 per cent. The average for the two periods was 26.3 per cent. Fruit growers who have an aptitude for bargaining and in getting work out of men would have reduced the costs. Shrewd salesmen might have added to the income.

Chapter XXVI

APRICOTS

Apricots resemble the peach in form and color. In texture and smoothness of its skin it resembles the plum. The seed, also, is more like the plum than the peach. Apricots have a delicious flavor and the fruit ripens somewhat before the peach and is excellent for canning and drying. The trees are hardy. The Russian varieties are harder than the European sorts.

The European Apricot (*Prunus armeniaca*) resembles the peach in form, the flowers appearing before the foliage. The Russian varieties belong to this group.

Apricots are grown quite generally where peaches are grown, both for market and home consumption.

Practically all of the important commercial production of apricots is confined to California.

Soil.—The apricot thrives in deep, rich soil, but the top soil and the sub-soil should be dry. The apricot will not thrive on wet land. Sandy soils and gravelly soils, where the drainage is good may be too dry; these should have sufficient moisture to keep the trees flourishing. The apricot is grown on clay soils and even on adobe.

Stocks.—Apricot, peach and plum stocks are used in propagating. Plum stocks are best for wet or heavy soils. Apricot stocks are used quite generally in California. In the East, most of the apricots are produced on peach stocks.

Planting.—Spring is the best planting time in the East. In California planting is done in the autumn, after the leaves fall. Apricots are planted anywhere from 15 by 15 feet to 24 by 24 feet on deep, rich soils. Some strong growing varieties like Moorpark and Royal should be given plenty of room.

It is a good plan to whitewash the whole tree as soon as planted, to protect from sunburn which is sometimes troublesome.

Cultivation.—In the East the cultivation is similar to the peach. In California, irrigation is the custom, except where there are heavy, penetrating winter rains. The trees should have sufficient moisture to keep them growing vigorously.

Pruning.—The trees should be headed low and the branches arranged spirally around the trunk. After the heads are formed, the only pruning required is the removal of undesirable branches. Pinch back branches that grow too rapidly and rub off buds that will start unwanted growth. Any other pruning needed may be given in the dormant season.

The head should be kept open so the fruit will receive the sun. Over bearing is prevented by reducing the number of branches.

Thinning.—Thinning to obtain large sized fruit should be begun before the pits get hard.

Climate.—The apricot blooms early. It is one of the earliest fruit trees to bloom, and in consequence is likely to be damaged by late frosts.

In California heaters are used in the orchards where there is danger of frost. Even after the fruit is set, it will be ruined by a temperature of 30 to 31 degrees if only for a matter of a quarter to half an hour. The heaters raise the temperature as much as five degrees when enough of them are used.

Harvesting.—The fruit is picked with the stem attached, by a gentle upward turn, in tin pails or baskets which are emptied into big boxes holding about 40 pounds. The boxes are filled to a depth of only six inches and kept in the shade until sent to the packing house.

Canners require firm, ripe fruit, running 12 to 16 to the pound. For drying the fruit must be riper than for canning.

LEADING VARIETIES

Alexander.—Russian. Hardy; prolific. Fruit large, yellow, flecked with red. Sweet and delicious. July.

Alexis.—Russian. Hardy, abundant bearer. Yellow with red cheek. Rich, slightly acid.

Blenheim.—Popular in California. Good bearer.

Budd.—Hardy and productive. Fruit medium to large, light orange, with blush on sunny side. Peach flavor, sweet and juicy.

Early Golden.—Small fruit, pale orange, juicy and sweet. Hardy, productive.

Gibb.—Hardy, productive. Fruit medium size, yellow, sub-acid, juicy. One of the earliest. Russian.

Harris.—A hardy English sort. Medium size fruit, oblong, orange, red cheek, good quality. Very early. One of the best for the East.

Montgamet.—Fruit large, round, deep yellow with pink blush, juicy and sweet. Tree hardy and vigorous.

Moorpark.—Fruit large, orange with red cheek. The tree is large, hardy and productive. Not an early variety. Good for dried fruit in California.

Newcastle.—An early California shipper. Medium size fruit, round but not of high flavor. Tree medium grower and uniform bearer.

Royal.—Fruit is large, round, orange with pink cheek. Flesh is yellow, firm, sweet and highly flavored, juicy. Ripens late in July in New York.

Superb.—A Kansas seedling. Claimed to be the best flavored, most productive variety. Medium size, light salmon color.

Tilton.—Largely grown in parts of California. Blooms later than Royal, avoiding injury from late spring frosts. Fruit is large and of good form, coloring before ripe. Tree is vigorous and productive.

Chapter XXVII

CHERRIES

The leading states in cherry production are California, New York, Michigan, Pennsylvania and Ohio. The cherry, however, is grown quite universally throughout the United States.

Varieties.—The sweet cherry is a larger, taller tree than the sour cherry. The Duke cherries are hybrids, a cross between the sweet and sour cherry, including the May Duke and Late Duke which nurserymen class as sour.

The choke cherry grows wild in the Adirondack Mountains and along the St. Lawrence River and is cultivated to some extent, by the farmers in that section. The fruit is small, dark and sweet. The trees seem to be long lived, and are hardy and vigorous. This variety may be very useful for hybridizing. The botanical name is *Prunus virginiana*.

Prof. Hansen of South Dakota has used the sand cherry, *Prunus basseyi*, for crossing with cherries and plums. Some of the resulting varieties have been of great importance to the West.

Soil and Climate.—Cherries do well in western New York where they are grown commercially, also in Michigan, Ohio, Oregon, Washington and California.

As compared with apples, cherries thrive on a small supply of water, but they will not do well in dry climates. Where cherries have an excessive supply of water, the life of the tree is shortened.

The sweet cherry does best on a deep soil that is well drained, but for home use it grows sufficiently well on a great variety of soils. The sour cherry is less particular in its soil requirements and will thrive even in dry climates if it has sufficient moisture at the roots, with good drainage.

Planting.—Cherries are planted at different distances according to soil, climate and the grower's ideas. The sour cherries are planted from 15 by 15 feet to 18 by 22 feet apart, and the sweet cherries from 20 by 20 feet to 24 by 30 feet. Plenty of room is advisable in preference to crowding. Plant in the spring before the buds start or in the autumn. Never expose the roots of cherry trees to sun or wind and keep them moist from the time they are dug until transplanted. Cherry tree roots are easily injured by exposure to sun or wind. Two-year-old trees are usually planted in the East and one-year trees on the Pacific Coast. One-year trees are easier to head low than older trees.

Pollination.—On the Pacific Coast the blossoms of some varieties of sweet and sour cherries are sterile, including Lambert and Napoleon and varieties such as Coe and Norma are interplanted with Lambert and Napoleon and Elton with Bing.

Cultivation.—Sour cherries are cultivated in the East until July, when they are seeded to cover crops. Sweet cherries are cultivated until July and seeded to cover crops until the trees are four years old. Then a crop of grass is grown to take up surplus moisture or crops of rye or oats are sown to take out the surplus moisture in the autumn.

Pruning.—Low headed, open center sour cherry trees are preferred for ease of spraying and pruning. With low-headed one-year trees, the center is removed about two feet from the ground, and the limbs trained to form a good round head.

The sweet cherry may be pruned and trained the same as the sour. If to be grown in an upright form, the branches are allowed to form spirally around the leader, avoiding crotches, all branches are prevented from developing below the lowest main branch, by rubbing off the buds as soon as they appear.

Fertilizers.—Sweet cherries do not seem to need much fertilizing. Sour cherries must make good growth to produce good crops. They must make good terminal growth which cultivation and cover crops will likely cause, but if not, fertilizer will be needed. This may be a high analysis complete fertilizer or nitrate of soda or calcium nitrate. The need of one of these is indicated by poorly colored foliage.

Harvesting.—Where fruit is delivered short distances to canners, it is picked when ripe. Fruit to be shipped must be picked earlier and with care. Some canners and juice makers take cherries without the stems, in which case the cherries are rapidly pulled off the trees without the stems. In this condition they spoil quickly. Fruit for market must be picked with the stems and by taking hold of the stem. A tin pail of convenient size with a hook on the handle is used for picking and the fruit is sent to the packing shed as soon as possible.

Packing.—Frames covered with canvas are used for sorting fancy fruit. Pacific Coast cherries are packed in eight or ten pound boxes. Eastern cherries can sell as well, if sent to market in equally attractive style.

On the Western Coast, No. 1 fruit must be $\frac{3}{4}$ of an inch in diameter and "fancy" $\frac{7}{8}$ of an inch.

Fruit sent to canning factories does not require sorting. Most cherries are grown for the canning trade. Sweet cherries in the markets of the large Eastern cities are seldom plentiful and are high priced. Sweet cherries are somewhat delicate and perishable, but it does seem as though a much better market might be made for them in the East.

Propagation.—The cherry is propagated by budding on Mahaleb and Mazzard stock and sometimes by root grafts. The former, a European cherry, is most generally used.

The Mazzard is a sweet wild cherry and trees propagated on this stock live the longest and cost more to produce but are worth more than on Mahaleb stock. The reason is that in budding on Mazzard, only about fifty per cent or less of the stock budded will succeed. The other fifty per cent will be lost.

The nurseryman therefore has lost half his stock, his buds, the cost of labor and the use of the land for half of the stock that did not "take" or succeed. Trees on Mazzard roots, if properly planted are quite sure to live, while the loss on Mahaleb roots will be larger. Mazzard is by all odds the best stock for sweet cherries.

Mahaleb stock may be better for stony, sandy or dry soils. In the West the sand cherry is used for sour cherries in cold, dry regions.

Sweet Cherries are grown largely on the Pacific Coast. East of the Rocky Mountains it is estimated that more than eighty per cent of the cherry trees are sour. The popular varieties are Montmorency, Early Richmond and English Morrello.

The leading sweet varieties are Napoleon, Windsor, Black Tartarian, Lambert and Wood. In the West, Napoleon is the popular sweet variety.

VARIETIES

Dr. Hedrick describes more than 800 varieties, but only a few are of commercial importance.

B indicates Biggareau

Sr. indicates Sour

D " Duke

St. " Sweet

H " Heart

Abesse D'Oignies.—D. Large, dark red; quality fine; late; ships well. Tree vigorous, hardy, productive, free from fungus.

Bessarabian.—Sr. Small, astringent. Tree dwarf, hardy, healthy. Used in the cold Central West.

Bing.—St. B. Popular on Pacific Coast. Large, dark red fruit, quality good; good shipper. Mid-season. Tree vigorous and productive.

Black Tartarian.—St. H. A favorite in the East. Fruit dark red, medium size, juicy; quality good. Good for home or nearby markets. Tree vigorous and prolific.

Coe.—St. H. An excellent home variety or for nearby markets. Fruit large, yellow with red blush. Tree healthy, productive and hardy.

Downer.—St. H. Fruit of good size and good quality. A good late, sweet variety for home use.

Dyehouse.—Sr. Similar to Early Richmond, but earlier. Fruit small. Tree small.

Eagle.—St. H. Fruit black, medium size, of good quality, but not large. Follow Black Tartarian in ripening. Tree hardy, vigorous, healthy.

Early Purple.—St. H. Fruit large, dark red. Good for home use or local market. Requires a warm loam soil.

Early Richmond.—Sr. The most popular early sour commercial variety. Medium sized fruit. Not a good shipper. Tree thrives most anywhere.

Elton.—St. H. Fruit yellow, with red blush. Early. Quality excellent. Subject to brown rot. Tree likely to suffer from severe cold.

English Morello.—Sr. The standard late sour. Ships well. Resists brown rot. Trees small and drooping.

Ida.—St. H. Fruit large, light red. Fine quality. Early. Good for home use.

Kirtland.—St. B. Suitable only for planting in good soil. Fruit yellow and red, of fine quality, firm and resists brown rot.

Lambert.—St. B. Dark red, of fine flavor and quality, of good size. Mid-season.

Late Duke.—D. Fruit of fine quality, ripening after May Duke. Tree hardy and productive. Good for home use and local markets.

Louis Philippe.—D. Fruit large, red, tart when mature. Tree vigorous and spreading.

Lyons.—St. H. Fruit large, dark red of good quality. Extra early. Tree vigorous. A good commercial variety or for home use.

May Duke.—D. Fruit medium size, dark red, with small pit. Ripens early but hangs well. Sub-acid when ripe. Trees thrive in various soils and climates. Fruit ships well. Trees hardy, vigorous and healthy.

Montmorency.—Sr. Probably the most popular of all cherries. Fruit of medium size, light to dark red, with yellowish flesh. Fruit may be used before it is ripe and is resistant to brown rot. Ships well. Tree healthy, vigorous and productive. In the East, this is the leading canning cherry.

Napoleon.—Also called Royal Ann. St. B. Fruit is large, firm, yellow, blushed with red, rich and sweet of finest quality. Mid-season. Trees hardy, vigorous, healthy and productive and bear when young. The leading sweet variety. Excellent for home or for market.

Ostheim.—Sr. Suitable for cold sections where other varieties cannot be grown, especially the prairie states. Fruit dark red. Late. Hardy.

Oxheart.—St. A general name applied to white-fleshed sweet cherries such as White Biggareau, Napoleon, etc.

Republican.—St. B. Fruit large, black-red of fine flavor. Only suitable for good soil.

Royal Duke.—D. Fruit large, red and of good flavor and quality. Ripens between May Duke and Late Duke.

Schmidt.—St. B. Fruit large, very dark red, firm, juicy and of fine flavor. Very resistant to brown rot. Tree vigorous, healthy and productive. Good for market or home use.

Vladimir.—Sr. A Morello type, but the tree is smaller. Useful where a very hardy tree is required.

Windsor.—St. B. Fruit large, dark red, almost black; light red flesh of fine quality, not subject to brown rot and ships well. Tree is hardy, healthy and productive and thrives where other sweet cherries fail. Mid-season to late. Good for home or commercial purposes.

Wood.—St. H. This variety is suitable only for home use or home markets. Fruit is large and handsome, of good flavor, but soft. Tree is not as hardy as other varieties. Early.

Yellow Spanish.—St. B. Fruit yellow, medium size, of good quality. Ripens between Wood and Napoleon. Tree large, vigorous and productive. Bears young. Good for commercial purposes or home use.

Chapter XXVIII


PEACH AND NECTARINE

Peaches are grown for home use over a wide area and on a great variety of soils, in almost every state, but peach growing is not a success generally where the thermometer regularly falls to 20 degrees below zero. In a small way, market gardeners and farmers grow peaches in Ontario, Canada, near Brockville, Ontario, for instance, where 20 degrees below zero is quite common. A light freeze in Georgia is apt to do more damage than the severe winters of western New York or Connecticut.

Maryland, Delaware, New Jersey, New York and Connecticut are important peach states of the East. Georgia is the leading peach state of the South, followed by Texas, Arkansas, Alabama, Oklahoma, North and South Carolina, Tennessee and Kentucky. In the Central States, Missouri, Michigan, Illinois and Indiana.

In New York, Ontario and the Northern Central States, the peach belt is along the lakes where the climate in winter is modified by the lakes. Low winter temperatures and high winds at the same time are particularly unsuitable.

Whether a northern, southern, eastern or western exposure is desirable depends upon local climatic conditions.



Soil.—In the North, peaches do well on sandy soil, which is preferred. They also do well on loam. On rich land there may be too much growth; in poorer soils growth is regulated by fertilizing. Very light sandy soils may require too much fertilizer and, except where rainfall is plentiful, are apt to be too dry to make peach growing profitable. A warm, dry soil tends to produce hardy trees in the North. Too much moisture or too little, results in winter killing of the trees.

Planting.—A good average distance for planting is 15 by 15 feet, but planting is sometimes closer than this and up to 20 by 20 feet. Spring planting is best for peaches.

Pruning.—At planting, the tree is pruned to a whip about two feet long. Low headed, spreading trees are desirable. Where a high headed tree is desired, the top is cut back only a little and four or five branches left, the branches shortened only a little.

The branches formed the first year are allowed to grow. Late in the winter they are thinned to four, the main limbs, and these may be shortened a little. The next year little pruning is given and a few fruits may be produced. The small, central branches bear the first fruit. The fourth year, the pruning is done with a view to spreading the tree, with the branches so arranged that the sun will reach all the fruit to insure size and color.

In sections where trees are long lived, thriving for twenty years, pruning is done to bring in new wood, by cutting out old limbs. At seven or eight years, a limb is headed back so it will send out new shoots.

A certain amount of pruning should be done each year. Some growers prune very little.

Winter Pruning.—In some sections winter pruning is done, but it is not well to prune peaches when the wood is frozen. Heavy pruning should be delayed until the sap starts, but before the leaves start in the spring.

Pollination.—Some varieties, such as the J. H. Hale, do not pollinize themselves well and other varieties should be planted with them to insure good crops. For commercial orchards, it is advisable not to grow many varieties.

Inter-Cropping.—While the trees are young, that is for the first two years after planting, low growing crops may be raised with the peaches. Do not grow grain, raspberries or other brambles with peaches.

Cultivation.—Cover crops are desirable to be worked under with a disk harrow or other tool that will not go deeply into the soil. Soy beans red clover, buckwheat, and crimson clover where it will grow (crimson clover is unsuitable for the North). Even weeds are allowed to grow, but are worked under before seeding. Cover crops should not be permitted to take moisture from a growing crop.

Cultivation should be given from early spring until July. If the season is dry, cultivation should be continued until the crop is harvested. Let nothing grow, in that case, to take moisture from the trees.

Hardy Varieties.—Prof. Hedrick of the New York State Experiment Station gives the following list of varieties as being the most hardy. Severe winter weather is usual at this Station, with a rather heavy fall of snow: Chili, Crosby, Gold Drop, Barnard, Fitzgerald, Kalamazoo, Triumph and Wager.

Crosby, Chili, Stevens, Gold Drop and Elberta are the most hardy in wood and Crosby, Chili, Triumph, Gold Drop, Kalamazoo and Stevens the most hardy in bud.

Heat Absorption by Bark.—A modern idea in fruit growing as applied to peaches is consideration of the color of the bark of the trees. Trees with purple bark absorb heat rays readily. Trees with green bark do not absorb heat rays so readily. The point is this, on a warm day early in the season, trees with purple bark absorb heat rays and the temperature of the plant will be many degrees warmer than the temperature of the air. These trees may start into growth and the buds swell and be injured by cold, when dormant buds will be safe. They are also likely to bloom early and be damaged by frost.

Protection Against Frost.—Heating pots are used on the Pacific Coast to prevent damage by frost at the blooming season. Seventy to eighty pots are used to the acre and the pots are kept in readiness for instant use at that season. In the East, orchard heating has not, up to this time, been considered as worth while.

In the South, peaches are cultivated so the leaves will hang until the late frosts cause them to fall. This keeps the buds from starting early in the spring. The sooner trees go into a period of rest in the autumn the sooner they start into growth in the spring. The trees must not be fertilized late in the season as this will keep them growing late so the wood will not mature properly and seasonably in the autumn. That will lead to winter killing. The desired result is obtained by heavy pruning in late winter or early spring to stimulate growth, good cultivation continued through the summer and the use of nitrogenous fertilizers, early in the season. Nitrogen used late will prevent proper maturity of the wood for winter weather.

Propagation.—Peaches are propagated by budding on seedlings. Seed of wild peaches from North and South Carolina and Tennessee are used for this purpose. They are free from “yellows” and produce vigorous plants. The seed is planted with a planting machine in rows forty inches apart and two inches apart in the rows. The seed may be stratified over winter, then it will crack when the kernels are planted.

In September the seedlings are budded and grown on the following season when they are offered as one year trees. The budding in Southern nurseries is done in June. As soon as the bud takes, and makes a good growth, the top is cut off to throw the whole strength of the stock into the budded variety.

The longest lived peach trees the author has seen in the East were said to have been budded on stock grown from seed that had never been transplanted.

Damson and St. Julien plum stocks are used for peaches to be grown on heavy land. The hard-shelled sweet almond is used in California for trees to be grown on dry soil. *Prunus davidiana* or David’s peach is used for stock to be grown in California and Texas. It stands alkali that other stock will not and it has also stood lower temperatures than any other.

Thinning.—Thinning is performed after the summer drop, when the trees are heavily laden with fruit. At this time the seed is beginning to harden. Thinning in some instances is done by heavy pruning, otherwise the fruit is thinned so each fruit remaining will have ample room to develop. Producing too large a crop will weaken the tree.

Harvesting.—Peaches are at their best when ripened on the tree. This, however, is only for consumption at home. Fruit

sent to market must be so timed in picking that it will reach the market so it will not be quite ripe when purchased by retail buyers who are to consume it, because they expect it to keep a day or two after it is purchased. For some markets at a distance, the fruit will therefore require picking a week before it is ripe. Home markets require ripe or nearly ripe fruit. Before it



PEACH TREE—TEN YEARS OLD
Propped to support heavy load of fruit

is picked, the skin should show some color on one side and greenish white on the other, if for distant shipping. Belle of Georgia, a good shipper, is picked when white, but firm. Learn to judge fruit by the eye, as pinching damages it.

A good picker takes the fruit gently in the palm of the hand, turns it slightly and lifts it carefully to separate it from the stem. A good picker, with standard varieties that run even in size will pick from thirty-five to forty bushels a day.

For shipping, the fruit is carefully hauled in spring wagons to the packing shed where it is graded and packed. For canning and home markets the fruit is often sent directly to market from the orchard.

Grading and Packing.—The fruit is graded in a grader that sorts it into three or four sizes. The defective or ripe peaches are removed from the grade by hand, by women who stand along the conveying belt. The graded fruit falls into baskets and as soon as they are filled, a cushion and cover are placed over them, stenciled and immediately put into cold storage before loading into the car.

Packs.—The Georgia carrier is used extensively in the East. In New York 10, 14 and 16 quart splint baskets are common. Pacific Coast peaches sold in the East are packed in boxes 5 x 11 x 18 inches. The bottom and sides are $\frac{3}{8}$ inch material and the ends $\frac{3}{4}$ inch.

Georgia carriers are shipped in refrigerator cars having a floor rack. The carriers are loaded seven in a row. Two inch pieces of wood are placed over the carriers the full width of the car and nailed firmly. Five or six tiers are loaded and the carriers are braced at the doorway so all will be held firmly in place.

LEADING VARIETIES

The best variety to plant is largely a matter of location. The variety must be one that will do well in the locality where it is to be grown and a variety that is known and in demand. The fruit must be large, of attractive color, firm and a good shipper. For home use shipping quality is not of importance. A new variety may be introduced successfully, locally, if of better size, color and quality than the fruit the market has been using.

Elberta is the leading variety of the East. It is a mid-season variety. **Belle of Georgia**, **Carman** and **Champion** are white varieties which arrive before Elberta.

Alexander.—Medium, nearly covered with red; juicy, melting, sweet. July. Freestone.

Banner.—Hardy in wood and bud; bears young; productive. Fruit large, deep yellow with crimson cheek; flesh yellow, of good quality. Firm. Late September.

Barnard.—Medium; yellow. Juicy and rich. Hardy and productive. Early September.

Beers.—Fruit large with yellow flesh. An improvement on Smock Free, ripening later and is a better annual bearer. Good for late canning.

Belle of Georgia.—A leading Southern variety. A creamy white freestone, with crimson cheek. Trees are hardy, vigorous and productive. Of good quality. Flesh is white and firm. Tree is hardy and prolific.

Bilyeu.—A large white freestone, used locally in California.

Brackett.—Yellow freestone ripening after Elberta. A Southern variety.

Capt. Ede.—A handsome yellow freestone, having a faint blush of carmine, resembling Elberta. Ripens about a week before Elberta. Hardy in bud and blossom. Popular South.

Carman.—Does well in climates and soils where others fail. Color is brilliant red, splashed with darker red on creamy white background. Flesh creamy white with red tinge. Flavor spicy and good. Especially suited to low land inclined to be damp, where other varieties will not grow. Hardy, productive and a good shipper. Inclined to overbear and may need thinning. Freestone. Middle to last of July.

Champion.—A white freestone. Tender, juicy and sweet and of large size. The flavor is delicious. A little tender for shipping. Late August. Vigorous and productive. Tree is rather particular as to soil.

Chairs Choice.—Fine quality and flavor. Large yellow freestone of good color. Flesh firm. Prolific. Good for home market. October.

Chinese Cling.—Large white, shade red. August.

Climax.—White freestone. A Florida commercial variety.

Crawford's Early.—A yellow freestone peach of good quality. Tree vigorous, but not as productive as some others. First of September.

Crawford's Late.—Similar to above but later.

Crosby.—A yellow freestone blushed with red that grows farther north than other varieties. The tree is hardy, vigorous and productive. The flesh is yellow and delicious. Smaller in size and less attractive in unsuitable soil. Notably hardy in bud. September.

Elberta.—The Elberta is the most popular peach in America at this time and the leading commercial variety. It does well in many soils and climates, withstands attacks of insects and disease, is long lived and very productive, bearing at an early age. The fruit is large, golden yellow, with brilliant red cheek, firm, juicy and sweet. Ships and keeps well. Freestone. In northern New Jersey ripens in late August or September.

Fitzgerald.—Yellow freestone, resembling Early Crawford but ripens a little earlier. Trees hardy, moderately productive. Fruit firm, tender and sweet.

Florida Gem.—An early white freestone, grown in the South.

Fox is a white freestone of good quality for the South.

Gold Drop.—A late yellow; follows Late Crawford. The fruit is of medium size and of good quality. Trees are hardy, productive and bear at an early age and are resistant to leaf curl and brown rot.

Greensboro.—The fruit is nearly double the size of Alexander, ripening at the same time, beautifully colored, bright red over yellow. The flesh is white, juicy, and not so subject to rot as are most varieties. Owing to hardness of tree and bud, this variety is worth trying where others do not succeed. Free or semi-cling.

Heath Cling.—An old favorite. Large, white, juicy and melting. One of the best clingstones. Middle of September.

J. H. Hale.—Fruit larger than Elberta which it resembles. A good shipper and keeper. Ripens before Elberta. This variety is not fully productive without another variety planted with it as a pollenizer. Freestone.

Hiley or Hiley Belle —Large, white with red cheek. Similar to Belle of Georgia. Ships and keeps well. Tree hardy.

Hill's Chili.—Medium sized fruit, yellow, shaded red. Flesh yellow, sweet and rich. Hardy and productive. September. Freestone.

Jewell.—Light yellow, early freestone of medium size. Grown in central and southern Florida.

Kalamazoo.—Large golden yellow with crimson cheek. Flesh yellow of good quality. Small pit. Strong grower, bearing at an early age. Hardy and productive. Ripens with Late Crawford. Fruit usually not quite as large as Elberta, but of fine quality. Freestone.

Lemon Cling.—Large, pale yellow, dark red cheek. Hardy and productive. Used in California for canning. September.

Lemon Free.—Lemon shape and color. Large, productive; excellent for canning. Largely grown in California. Late mid-season.

Mamie Ross.—A white peach, ripening in mid-season, used commercially in Texas.

Mayflower.—Bright red cheeked. A good early market variety. Inclined to overbear and requires thinning. Clingstone.

Mountain Rose.—Large, red, with white flesh. Juicy and good. August. Freestone.

Muir.—A yellow freestone. Vigorous, productive. Grown in California for canning. Late mid-season.

Niagara.—Large oval, yellow fruit with red cheek. Rich and delicious. Tree hardy, healthy in leaf and bud. Bears abundantly when it does well and is one of the best for market, but it lacks productiveness in some localities, possibly needing a pollenizer. Ripens after Elberta Freestone.

Old Mixon Free.—Large, light yellow with red cheek. Flesh white. Freestone. September.

Rochester.—One of the best early varieties, ripening two weeks ahead of Early Crawford. Bears at early age. Fruit large, yellow, mottled red. Flesh thick, firm, juicy and sweet. Tree hardy, vigorous and productive. Tree inclined to overbear, in which case the fruit should be thinned.

Salberta.—Two to three weeks later than Elberta. Yellow. A new variety that seems to have merit.

Salway.—Large yellow with crimson cheek. Flesh deep yellow; red at pit. Sweet and juicy. A good late market variety.

Sellers Cling.—A popular California mid-season variety for canning. Yellow, Clingstone.

Slappey.—A medium yellow variety of good quality, grown in the South, where it ripens before Elberta.

Stearns.—Yellow flesh and brilliant red skin. Tree very hardy and vigorous. An excellent shipper. Follows Elberta. Freestone.

St. John or Yellow St. John.—Medium size, orange yellow. with red blush. Tender and juicy. One of the earliest yellow peaches. Tree strong grower and regular bearer. Not productive everywhere, but a good variety for home use generally. Freestone.

Thurber.—White, mid-season for the South. Not good shipper. Freestone.

Tuscan Cling or Tuskena.—Early yellow Clingstone used for canning in California.

Wilma.—A new variety of promise. A yellow freestone, a little later than Elberta, its parents. Trees are vigorous, productive and hardy. The fruit is large, handsome and of good quality; yellow, blushed with bright dark red. Flesh is tender, juicy, of good flavor and quality.

NECTARINES

The nectarine has a smooth skin, like the plum. It is like the peach in other respects. but the fruit is smaller, has firmer flesh of a distinct flavor. They are really peaches without the fuzzy skin.

Nectarines are grown quite largely on the Pacific Coast and they can be grown anywhere that peaches thrive.

Varieties.—For the East, Boston, a bright yellow, is good, also Red Roman. In California, Hardwicke, Lord Napier and New White are popular. In the Southern States, Breck, Griffith and Tough are popular.

Nectarines are popular in Europe and they deserve more consideration by eastern fruit growers. Dr. M. P. Hedrick, horticulturist at the New York State Experiment Station, has grown 30 varieties of nectarines at the Station and finds they have many good qualities. He is of the opinion the fruit will prove profitable for local markets and roadside stands. Europeans who know nectarines better than Americans, prefer them to peaches.

Nectarines may come from peach pits, and peaches sometimes from nectarine stones. Peach trees sometimes produce nectarines on a twig, the rest of the tree bearing peaches. There are clingstone and freestone nectarines and the flesh is red, yellow or white.

At the New York Experiment Station the best are Hunter, Downton, Elruge, Hardwicke, Newton and Victoria.

Chapter XXIX

PEARS

Pears are largely grown on the Pacific Coast and in most of the Eastern States. In the South only two varieties are grown to any extent, Keiffer and Le Conte.

Clay loam seems best for pears and it should be deep. On light soil the trees are short lived. Very rich soils are not regarded as favorable.

Propagation. Some pears including the varieties popular in the South, Kieffer and Le Conte, can be propagated from cuttings, but most varieties are produced by budding on stock raised from seed. French pear seedlings have been used in the past, but restrictions on imported plants will likely compel the production from seed of all stock in this country.

Fire blight being troublesome on the Pacific Coast, Japanese seedlings are used there for propagating stock.

Double Worked Stock.—Quince stock is sometimes used in propagating the pear. It is always used for dwarf pears. Some varieties do not unite readily with quince stock and what is known as double working is resorted to. A variety which unites well with the quince is budded on to the quince stock. Usually Duchess is used for this purpose. Anjou is also used.

When the Duchess branch is of sufficient size any desired variety is budded on to that, so in a double worked tree, the root will be quince, the base of the trunk one variety and above that another variety. Dwarf pears should be planted deep enough to cover the union of the quince and pear two or three inches.

Planting.—What applies to planting pears, applies to planting trees in general, except the age of the tree. One or two year old trees are used. The roots should be looked over and any broken pieces pruned off clean, with a sharp knife. The roots should be spread out in their natural position, then covered, the soil packed firmly about the roots with plenty of water in the hole. It pays to plant trees well,—each individual tree. To do so saves time, money and labor. The planting should be done before the buds start in the spring, or perhaps, better do the planting in the autumn.

One year old trees are usually preferred and are headed low, set 20 feet apart in rows 25 feet apart. Dwarfs are set from 12 to 16 feet apart

Pruning and Shaping.—Pears quite generally form good shaped trees when left to themselves, but may require a little pruning to keep the tree in shape.

Pears blossom and develop on spurs. These branch and continue bearing for years before renewal is necessary. If the tree produces a mass of bloom and no fruit, sufficient fruit spurs must be removed, the object in pruning being to obtain a uniform setting of fruit, through just sufficient new wood to keep the tree bearing properly.

In the East, pears are given the same cultivation as apples. In the West pears are irrigated and otherwise given the same cultivation as apples.

Pollination.—Strangely, pears in some sections of the country pollinize themselves, and in other sections do not. Bartlett is self fertile in New York but is sterile in California. Varieties that show this peculiarity will be improved in the matter of yield, by cross pollination. For this reason Bartlett and Seckel do well together. Two rows may be planted of one variety and one row of another, or four rows of one variety and two of another; or alternate every other row. Cross-pollenized fruit ripens earlier than self-pollenized fruit.

Thinning.—Some varieties of pears require thinning to obtain good sized fruit, Seckel and Keiffer in particular.

Fertilizers.—For light sandy soils, where the trees are yielding, complete fertilizers will be needed. Cover crops turned under will also be useful.

Harvesting.—Pears are harvested before they are fully ripe. The fruit is gathered when it has obtained its size and about the time the seeds begin to turn dark. At this time the stem separates easily from the branch. Fruit picked too early will wilt, and left too long will not keep. Experience alone will tell when is just the right time.

Pears are delicate and must be picked and handled carefully. Baskets or boxes are used to carry the fruit to the packing shed.

Packing.—Pears have always been packed in barrels in the East, picked hard. The barrel never was a good way to ship pears. The box is the package for pears, or hampers such as used for peaches. Bushel baskets are used somewhat; a corrugated strawboard cushion is used between the top of the fruit and the cover.

The fruit must be firm on arrival at market or the dealers will not touch it. The fruit ripens quickly so it is soon ready for the retail buyer.

LEADING VARIETIES OF PEARS

Anjou or Beurre d'Anjou.—This is one of the best known, most popular late pears. The tree is vigorous, hardy and prolific. The fruit is large, green, yellowing when thoroughly ripe, juicy and of excellent quality. Ripens in October and keeps until midwinter.

Bartlett.—This is the leading American commercial variety. One of the best for canning. The fruit is large golden yellow, with a reddish blush on the sunny side. The flesh is white, juicy, sweet. Tree upright, vigorous and abundant bearer. Fruit ripens in September.

Beurre d'Arenberg is a winter variety grown on the Pacific coast. Not suitable for the East.

Beurre Bosc or Bosc.—A high quality fine flavored variety. The fruit is large, with tapering neck, golden russet skin. Flesh is fine-grained, juicy and melting, highly flavored and delicious. Does not do well as a dwarf. Erect grower and productive. Slow in coming into bearing. Ripens in September or October.

Beurre Clairgeau or Clairgeau.—The fruit is large, light yellow shaded with russet and crimson. Flesh yellowish and melting. Bears at an early age. Tree is upright and spreading. A winter pear that is growing in favor.

Clapp's Favorite.—Very productive and hardy. Fruit large, long, pale lemon color, flushed with russet red on exposed side. Flesh fine-grained, juicy and melting. Fruit should be picked before fully ripe or it will rot at core. Ripens before Bartlett.

Comice also Doyenne du Comice.—Grown in the West on account of good shipping quality. The tree is a vigorous grower. Fruit large, yellow with red on exposed side. Flesh yellow, juicy and of good flavor.

Duchess d'Angouleme or Duchess.—As a dwarf on quince roots this variety does exceptionally well, being a prolific and dependable cropper. It bears at a very early age. The fruit is large, larger on dwarf than standard trees. When ripe the fruit is golden yellow, with a blush on the exposed side, sometimes slightly russeted. Flesh white, juicy and of good quality. Season October. A good keeper.

Flemish Beauty.—One of the hardiest, producing good crops annually. The fruit is large and of fine quality. The flesh is juicy, sweet and of good flavor if picked early, but not good if ripened on the tree. September to October.

Garber.—A Japan hybrid. The tree is hardy, productive and bears at an early age. The fruit is larger than Kieffer, yellow with crimson cheek, useful for canning. This variety is most useful for the South.

Howell.—Vigorous grower bearing prolifically at an early age. Fruit is large, yellow, with red cheek. Fruit not of as good quality as other varieties.

Kieffer.—Very productive. Most useful for canning. Fruit is larger, golden yellow, tinted red. The trees are strong, vigorous growers on standard stock, but do not do well as dwarfs. Fruits at an early age and is resistant to blight. The fruit should be ripened in a cool dark place in an even temperature. In some localities it needs a pollinizer and Garber is used for this purpose. October to November.

Lawrence.—Tree is hardy, healthy and dependably productive. The fruit is medium to large, yellow, with melting aromatic flesh. An early winter variety.

Le Conte.—Tree vigorous, healthy, resistant to blight and a prolific bearer. Fruit is large, pale yellow, juicy and similar to Kieffer for which it is used as a pollinizer.

Lincoln.—This variety is used in the Middle West. The tree is vigorous, hardy and productive. Fruit is of medium size, greenish-yellow, russeted. Flesh yellow, of only ordinary quality.

Louise Bonne de Jersey.—Tree vigorous and upright. Fruit large, pale green in shade, overspread with brownish red in the sun. Flesh juicy and melting of good flavor. September to October.

P. Barry.—Largely grown in California. Fruit large, orange yellow and russeted. Flesh rich, juicy and of good quality. A winter pear.

Seckel.—The fruit is small, juicy, and the rich flavor makes it popular everywhere. Unsurpassed for pickling. No home grounds should be without it. As a dessert fruit it is excellent. The tree is compact in form, hardy, healthy and prolific. In season September—October.

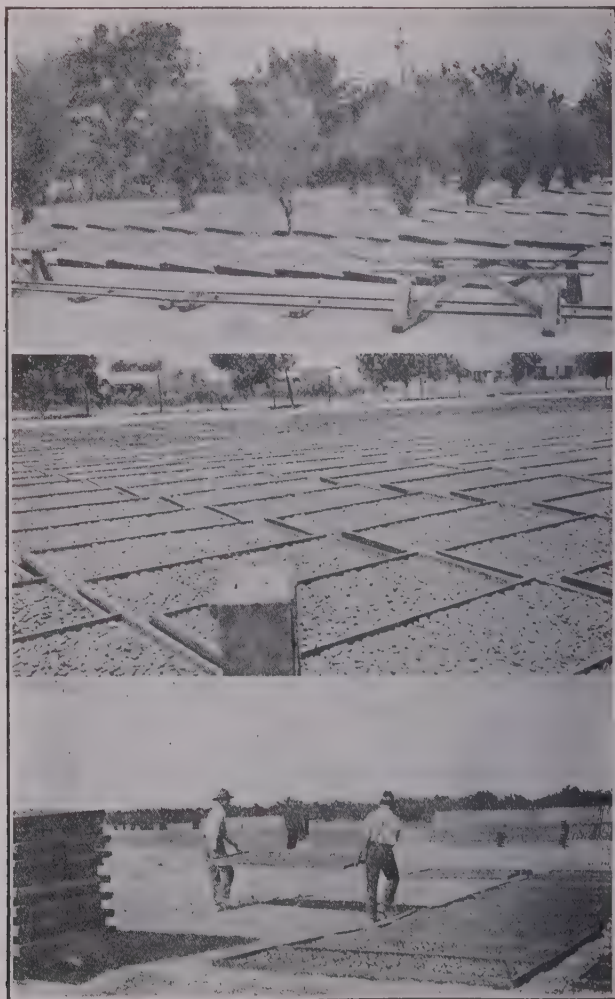
Sheldon.—Tree is vigorous, hardy and prolific. Fruit is large, round, greenish-yellow, russeted. The flesh is juicy, melting, of good quality and high flavor. Good for home use, the fruit has a tendency to drop before ready to pick, so is not a good commercial variety. Plant only standard trees; does not do well as a dwarf. October to November.

Vermont Beauty.—Tree is hardy and a strong, healthy grower bearing good crops. Fruit of medium size with yellow skin, shaded carmine. Flesh is fine grained, sweet and juicy, resembling Seckel, but ripens later and keeps better. October—November.

Wilder.—Fruit is medium to small, greenish-yellow with brownish-red cheek. The flesh is sweet, melting and pleasant, of excellent quality. This is one of the earliest pears. The tree is a vigorous grower and a good bearer. Good for home use or nearby market.

Winter Nellis.—Tree is hardy and a heavy cropper, bears at an early age regularly and abundantly. Trees of considerable age should have the fruit thinned. Fruit is inferior when the tree is overloaded. Needs good cultivation and thorough spraying. Fruit is of medium size, yellow, covered with russet. The flesh is yellow, sweet and fine grained. One of the best winter varieties when well cared for. December.

Worden Seckel.—An improved Seckel. Equal in quality to its parent which it resembles in flavor. The fruit smooth, regular, with a russet red cheek. The trees are hardy, make more rapid growth and excel the Seckel in productiveness and come into bearing at an early age. The fruit is considerably larger than Seckel. Ripens in October and will keep until Christmas.



PRUNES—TYPICAL SCENES IN FRUIT DRYING YARD, CALIFORNIA

Chapter XXX

THE PLUM

There are probably more distinct varieties of plums than almost any other fruit. There are an endless number of varieties of apples, pears, peaches and plums, and more are being produced constantly. Only a comparatively few varieties of any of these need be considered by commercial growers.

The voluminous works issued by the New York State Agricultural Experiment Station on plums, pears, peaches and apples, and which should be in every public library, show the great number of distinct varieties of these fruits.

Plums are grown quite generally throughout the United States and Canada, and in fact pretty generally throughout the temperate regions of the world.

Climate is the limiting factor in plum culture. A table, prepared by Prof. Hedrick, of the New York State Agricultural Experiment Station, gives the more important varieties, showing whether they are hardy or not in various locations; half hardy, meaning somewhat hardy or tender.

The tender will not stand the winters where they are severe. Half-hardy may survive some favorable winters or will survive if protected, but only hardy varieties are safe to plant.

In some places on the Pacific Coast, plums require irrigation. This is not so in the East. In the plains section only native varieties can be grown. Prof. Hansen of South Dakota has produced varieties of plums that seem promising for providing that section with hardy, productive trees, bearing fruit of good quality.

Soil.—Plums do well on a variety of soils, providing the drainage is good.

Planting.—Plums are planted anywhere from 12 by 12 feet to 20 by 20 feet, the distance depending on the variety and soil. Damsons may be planted quite close in some localities. Prunes will require the full twenty feet.

Some plums need pollenizers and this is accomplished by planting one row of pollenizer to every five of the main variety.

Planting one year old trees permits pruning to form low heads, which is desirable.

Propagation.—In the East, Myrobalan stock is generally used. Japanese varieties are sometimes propagated on peach stock. The American varieties are grown on American stock. On the Pacific Coast Myrobalan stock is mostly used although peach and almond are sometimes utilized. Budding in the East is done in July and August.

The Myrobalan stock is imported from France. They are easy to bud and a good union results. Peach stock will answer for trees to be grown on light, warm soils. Marianna stock is used in some places in the South. For dwarfing plums, stock of either the Sand Plum or Western Sand Cherry are used.

Pollination.—Some plums require pollenizers in order to bear. Others seem able to pollinize themselves in some locations and not in others.

In California the following Japanese plums are self-sterile. Abundance, Burbank, Combination, Kelsey, Satsuma and Wickson, as reported by Prof. Hendrickson. These varieties were able to pollinize each other. Of the European varieties, Clyman, Grand Duke, Robe de Sargeant and Tragedy are self-sterile and Imperial partially so. They can pollinize each other.

Cultivation.—Frequent cultivation should be given until the middle of July, when a cover crop is put in, clovers, buckwheat, etc. Early, very shallow spring plowing is given in some cases.

Fertilizer.—On good soil, the cover crop is likely to be the only fertilizer necessary, although the cover crop may need a little fertilizing.

Harvesting.—Plums bear from three to four years after planting. Some varieties are slower in coming into bearing.

Plums are harvested before fully ripe as they are used in this condition for preserving and they can be handled better than when ripe. They ripen well off the tree, but for home use, where that is possible, the full flavor of the plum is obtained in tree ripened fruit.

Grading and Shipping.—Fruit to be shipped is hauled to the packing shed where it is graded and packed in four, eight or ten quart Climax baskets and promptly shipped or placed in cold storage. The package used should depend on the market custom where it is sold.

Fruit sold to canners is gathered and then delivered in bushel baskets without grading or sorting. If to be shipped, it should be promptly placed in an iced car or sent to cold storage. Eastern plum growers have left the market for fancy fruit almost exclusively to the Pacific Coast growers.

In the West, the plums are gathered when hard ripe, for shipment East; they are handled with great care.

The fruit is packed in baskets with sloping sides, 8 inches square at top and $6\frac{1}{2}$ inches on the bottom and 4 inches deep. A sheet of paper is placed in the bottom and between each layer. Four of these baskets are packed in a crate, stenciled with the grower's name, or a colored label is used, stating the size of the grade and variety. It is certainly a credit to the Western growers, the condition in which their fruit arrives in the East after shipment across the continent.

The best keeping varieties in storage are Grand Duke, Kelsey and Wickson.

Prunes.—A prune may be said to be a plum which will dry when hanging on the tree, but plums that will dry on the tree in one locality may not do so in another. A better definition would be a plum that dries easily.

In California, prunes are permitted to drop naturally and finally the trees are shaken to get all the fruit. The fruit is put through lye and then run over a picking board to hasten drying. It hardly seems necessary to use chemicals in and on our food, a tendency that is growing. It is a wise man who will avoid all chemically treated foods. The fruit is graded into three sizes and put in trays and placed in the sun, until it is nearly dry, being turned once or twice. The trays are stacked in piles where the drying is completed. Ten days to two weeks are required for the operation. Then the fruit is graded by means of screens, and weighed.

Before packing the dried fruit is dipped in boiling water, then it is washed and packed. Dehydrating the fruit is taking the place of this older method. It is quicker and the result is a better product.

LEADING VARIETIES OF PLUMS

Abundance.—One of the oldest varieties. Tree hardy and productive; bears young. Fruit medium sized, amber, with red markings, juicy, sweet. Should be picked before ripe as it does not mature uniformly and drops. Botan. Case, Burbank No. 2, Douglas and others are practically the same. August.

Bavay or Bavay's Green Gage. Large, round, green, dessert plum and a good market variety. Keeps and ships well. Tree hardy and productive. Flesh golden, juicy, tender, sweet. Late. This variety and Reine Claude are practically identical. Late. European.

Bradshaw, also called Niagara and Large Black Imperial. Largely planted in East. Trees large, hardy, bear regularly and heavily. The fruit is purple, large, of good quality and ships and keeps well. Flesh yellow, sweet, juicy, semi-freestone. Ripens in August. European.

Burbank.—A very large, red plum, one of the best of the Japanese. Ships and keeps well. Flesh yellow, firm, juicy and sweet. Tree vigorous. Fruit may need thinning to obtain good size.

Clyman.—Grown in California for Eastern market. Flesh light yellow, sweet, mild but dry. European.

Diamond.—Fruit is attractive, large dark purple with beautiful bloom. Tree vigorous, productive and hardy. Quality is only fair. Mid-season. European.

German Prune.—A valuable dessert plum, good for market, preserving or drying. Fruit long, oval of good size, with a thick handsome bloom. Flesh is firm, sweet and pleasant. Keeps and ships well. Tree hardy and productive. Can be grown from seed. European.

Golden Drop is offered under various names. It is a European plum that does well on the Pacific Coast and in the South. It is good as a dessert fruit or for canning or drying. Tree is productive. Fruit large, yellow, juicy, sweet and tender. Late.

Grand Duke.—Fruit large, color of Bradshaw. Free moderate grower; productive, hardy. Not first class as a dessert fruit, but good for cooking. Season late. European.

Gueii.—Also called Blue Magnum Bonum. Tree large, hardy and productive. Fruit dark purple. Flesh greenish yellow, firm and tender, sweet, quality below the average. Only good for market.

Hanska.—This is one of Prof. Hansen's hybrids adapted to the Western Plains. Native.

Imperial Epineuse.—Large, purplish red with greenish yellow flesh, sweet and good, the largest of the prunes. Tree is large and productive. Season late. European.

Imperial Gage.—Large, oval, greenish. Flesh rich, juicy and delicious, one of the best. Tree hardy, vigorous, productive. Does best on light sandy soils and is particularly valuable on this account. Mid-season. European.

Italian Prune.—Also called Fellenberg. This variety is grown extensively in the West for shipping and drying. Fruit is of good size, purplish-black, with firm, juicy yellow flesh. Trees are large, hardy, productive and prolific. Requires good soil to bear well. Late. European.

Kelsey is a Japanese plum with large fruit of good quality. The tree is not hardy and is suitable only for planting in the South.

Lombard.—Adapts itself to widely different soils and does well where other varieties fail. The tree is extremely hardy, robust, healthy and a regular bearer. The skin is purplish red, covered with a thick bloom. The flesh is yellow, firm and sweet, not of the highest quality but does well for canning, cooking, etc. Tree inclined to overbear. Mid-season. European.

Monarch.—A handsome, large, purple, a perfect freestone. Flesh is golden yellow, juicy and sweet. Trees hardy and productive. Late. European.

Niagara.—See Bradshaw.

October or **October Purple.**—A strong, vigorous grower, productive and hardy for a Japanese variety. Fruit very large, round, purple, of good quality. Mid-season to late. Originated by Luther Burbank.

Peters or Peter's Yellow Gage.—Large oval, bright yellow. Fruit rich, juicy and of good quality. Tree large, vigorous hardy and productive. Late. European.

Pond or Pond's Seedling.—Red changing to violet, large. Flesh golden, juicy, sweet and mild. Tree medium size, hardy, vigorous. Late. European.

Red June.—A vigorous upright grower, productive, hardy and healthy. Fruit medium, vermilion red, of fair quality. Ripens a week before Abundance. Japanese.

Reine Claude.—See Bavay's Green Gage

Santa Rosa.—Large, purplish crimson fruit, with blue bloom. Flesh purple, shaded scarlet. The pit is small. Rich, fragrant and delicious. Tree a strong upright grower. Early. Japanese.

Sapa.—Another of Prof. Hansen's hybrids for use on the plains of the Northwest.

Satsuma or Blood.—Large, globular with sharp points. Purple and red with blue bloom. Flesh firm, juicy, dark red, quality good. Hardy and vigorous grower. Early. Japanese.

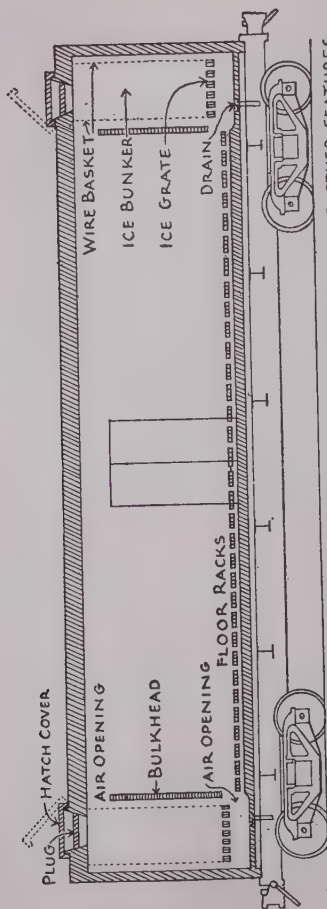
Shipper or Shipper's Pride.—A purple variety popular in the East. Not large enough or high enough in quality to equal other varieties. Purplish black, overspread with a thick bloom. Flesh greenish yellow, firm and sweet. Keeps well and an excellent shipper. Trees hardy and productive. Late. European.

Shropshire or Shropshire's Damson.—A fine old variety for canning and preserving. The tree is hardy, vigorous and productive. Dark purplish black, overspread with thick bloom, produced in thick clusters or groups. Flesh golden, juicy and tart. Late. European.

Wickson.—Large handsome fruit, maroon red, covered with white bloom. Flesh firm, yellow, rich and aromatic. Pit cling, but small. Tree an upright, vigorous grower. Good keeper and shipper. Early to mid-season. Japan.

Yellow Egg.—A large, handsome yellow plum. Good for home use or market. Golden yellow covered with thick bloom. Flesh firm, sweet, juicy. Most desirable for cooking. Trees large, vigorous, hardy and productive. Late. European.

York State Prune.—A good strain of the German prune, known also as Italian prune and Fellenberg.



PLAN OF REFRIGERATOR CAR SHOWING FLOOR RACKS, ICE BUNKERS, AND OTHER FEATURES
REFRIGERATOR CAR

Chapter XXXI

QUINCE

The cultivation of the quince for commercial purposes is quite largely confined to New York, Pennsylvania and Ohio, although it is grown for home use over a wide section. There seems to be little demand for this fruit. The quince makes one of the most delicious jellies, but in this age of the growing popularity of the delicatessen store, housewives buy their jelly rather than make it at home. Factories that make jellies might easily make a demand for quince jelly. Quinces also make excellent jam and good ripe quinces, baked, served with cream make a splendid dish. Canned quinces are excellent. The public really does not know what fine fruit the quince is.

Quince bushes bear regularly. They do well on various soils and are easily cared for. Grow the plants in their natural bush form. Set the plants ten feet apart each way.

Propagation.—Quinces may be propagated by hard wood cuttings the same as grapes, and by layers. By either of these methods varieties true to name will be produced. Nurserymen generally propagate the quince by budding on Angiers quince seedlings. If the buds fail to take, the Angiers stock develops.

Pruning.—Quinces require little pruning, only enough to keep the bushes in good shape.

Good cultivation and cover crops are about all the fertilizing the quince requires. In poor soils a complete high analysis fertilizer may be needed.

Harvesting.—The fruit should be harvested as soon as it shows good color. It will also have considerable fragrance. Although quite hard the fruit should be handled carefully. Bruised spots soon discolor and spoil the appearance of the fruit.

Some rub the cottony fuzz off the fruit, giving it a bright, shiny appearance and pack in baskets for fancy trade. Quinces may be advantageously graded into three sizes. Baskets, hampers and barrels are used for packing.

Barrels are faced, as with apples, except that the stem end is not shown, the calyx end being placed so it will appear when the barrel is opened. The fruit is barreled in the same manner as apples, but it must not be pressed hard, as then it will not keep.

The bushes begin bearing when from three to eight years old and may produce for forty years thereafter. Meeche's Prolific often bears at three years. The bushes are low, if properly grown, and in this form are easy to spray.

VARIETIES

Orange is the most popular variety in the East. Vigorous, hardy. Ripens in October. Too early for the South.

Champion.—Fruit large, ripens late. One of the best for sections not subject to early frosts. Tree vigorous, bears young. Keeps well.

Meeche's Prolific.—Large, orange yellow fruit, very fragrant. Tree vigorous, hardy and productive. Ripens between Orange and Champion.

Borgeat.—Bears young and profusely. Large, golden fruit. Ripens after Orange and keeps till mid-winter.

Rea's Mammoth.—Is quite sure to ripen even in northern latitudes. The fruit is large, golden yellow and cooks up very tender. The flavor is exceptionally good. Hardy and productive.

Smyrna.—Does well in California. Vigorous grower, matures with Orange.

Chapter XXXII

GRAPES

Grapes grow wild over considerable portions of North America. *Vitis labrusca*, the Northern Fox Grape, is the parent of the Isabella, Concord, Catawba and other American grapes.

Vitis aestivalis or Summer Grape is common in the North and South.

Vitis cordifolia, Winter or Frost Grape, is common along the banks of streams. A somewhat similar variety, *V. riparia*, is a native of the West. Its roots are immune to phylloxera and varieties which spring from it are used for stock for European varieties.

Vitis vulpina, now called *V. rotundifolia*, is the Muscadine Grape of the South and is the original of the scuppernong, etc.

V. Girdiana is found along streams in southern California. It hybridizes with *V. vinifera*. The Mission grape is supposed to be a cross between these two.

V. aestivalis, Summer or Pigeon grape, is found from New England to Florida and as far west as Kansas.

Vitis vinifera is the European grape, grown in greenhouses in the North and in the open ground in parts of California. It has been grown in the open ground at the New York State Agricultural Experiment Station at Geneva, by grafting it on some of our native varieties.

If European grapes are to be grown in the East by this plan, use Muscat of Alexandria.

Grapes are grown for home use on a great variety of soils and over a wide range of territory. Commercially, California produces half or more of the total crop of grapes. In the East, the grape section is along the shores of Lakes Erie and Ontario; on the Finger Lakes of New York State; on the banks of the Hudson River; in New Jersey, Delaware, Maryland and in Michigan on the shores of Lake Michigan.

Soil and Climate.—The soil for grapes should not be too rich. Rich soil produces much vine and little fruit. The soil in the Finger Lakes district is quite stony. That along Lake Erie is mostly clay. In New Jersey it is light, sandy loam or clay. The grape requires a fair supply of rain, but too much is disastrous. Poor soil can be fertilized with manure or green crops, but too rich soil offers a more difficult problem.

Planting.—The land should first be deeply plowed and the plow can be used for making the furrow in which the plants are to be set. For home gardens the plants may be set 8 by 8 feet. For commercial vineyards it is better to have the rows 9 feet apart, the vines 8 feet apart in the rows. Weak growing varieties like Delaware may be planted in rows 8 feet apart.

Cut back the vines to three buds. Spread the roots out carefully and firm the soil over them, leaving the surface soil loose.

One-year-old plants of first grade are used for commercial vineyards. Be careful to obtain good, strong, healthy plants, rather than be influenced by low prices. Home gardeners prefer strong two-year plants.

Pollenizer.—Learn whether the variety to be planted will fertilize itself. If not, a row of a pollenizer which will do the work should be planted at intervals.

Fertilizing.—Fertilizing may be done through cover crops of clover or other plants. Manure may be applied if to be had reasonably, if the plants seem to require it. Nitrogen is the fertilizer which grapes seem to need most and potash is secondary.

Cultivation.—The cover crop is turned under in the spring, care being taken not to plow deeply, or a disk harrow is used to work the cover crop under. Cultivation is kept up through the growing season until the first of August with a harrow, when the cover crop is put in.

A grape hoe is used by some to throw out the rootworm when it is near the surface and about to lay its eggs on the canes. The furrow is thrown from the row and the sun will destroy many of the insects.

Pruning.—During the winter, when the plant is fully dormant, the vines are pruned, according to whatever pruning system is used. Usually nearly three-quarters of the vine is cut away.

The Chautauqua system is common in western New York for Concord and similar growing plants. Posts 6 to 8 feet are driven about two feet into the ground. A wire is stretched from post to post 28 inches above the ground, with another wire 30 inches high. Either number 9 or 10 galvanized wire is used, fastened with staples and placed to the windward of the posts. The posts are placed about 27 feet apart and are well braced at each end. The trellises are gone over every spring and put in order for the season.

In the South it is common to use three wires on the trellis; the first about 20 inches from the ground, the next a foot higher and a third a foot above that. Posts 8 to 10 feet are used.

The Chautauqua system requires the development of arms on the lower wire. These are permanent, at least for a time, and from these, canes are lead up to the top wire and tied. The upright canes are renewed annually. The side arms are renewed every few years, new wood being made to take their place.

Roadways should be left every 300 to 400 feet, wide enough so a team can pass easily with a loaded wagon of fruit or for whatever other purpose a team may be needed.



GRAPEVINE TRAINED TO KNIFFEN SYSTEM—BEFORE PRUNING

The Kniffen system consists of carrying the main trunk to the top wire, while side arms of the previous season's growth with eight to ten buds, are developed in both directions on each wire. Short spurs of new wood are retained near the center of the vine. The spurs and side arms being renewed each year.

On arbors or porch covers, the old wood which is not bearing new wood or that bearing weak canes, may be removed. Old vines that have not been pruned for some time, should be cut back gradually, taking two or even three years to get the vine in shape.

In pruning remember that fruit is produced on shoots growing from buds of wood of the previous season. Retain canes of medium size, removing weak canes and old heavy canes. Keep the bearing wood near the trunk.



GRAPEVINE TRAINED TO KNIFFEN SYSTEM—AFTER PRUNING

Summer pruning is simply the removal of unwanted shoots as soon as they start, while the growth is young and tender.

Propagation.—Grapes are multiplied by means of cuttings, 8 inches to a foot long, which are made in the autumn from well ripened wood. The cuttings should contain three joints. Make

the lower cut just below a node or joint and the upper cut about an inch above the bud.

The cuttings can be planted as soon as they are made, in well prepared soil as for a seed bed. The rows should be far enough apart to permit working between them and the cuttings set about five inches apart in the rows. The next autumn these will make one-year-old plants ready for sale. Placed in a greenhouse in the same manner, the plants will be ready to set out the following spring.



GRAPEVINE TRAINED TO FAN SYSTEM—BEFORE PRUNING

The cuttings can be stratified, that is buried in soil with the lower ends down, until spring, when they can be planted. Being well callused they will root quickly and start into growth. Concord and some others root easily. Others, like Norton, that give a poor percentage of plants from cuttings, can be layered. A branch is brought down to the ground without severing it from the plant. This is laid in a trench 2 or 3 inches deep and

covered with earth. At each joint, roots and a shoot will start. When well established these are then cut apart, making separate plants.

Grafting.—The grape grafts easily. The cions should be dormant and the work done in the early spring. European grapes are worked on to roots of American varieties which are



GRAPEVINE TRAINED TO FAN SYSTEM—AFTER PRUNING

resistant to phylloxera. The graft must be well protected with grafting wax.

Some American varieties in New York State are said to be more productive when grafted on more vigorous stock. The Concord, which is a heavy yielder, is one of the varieties said to be improved by this treatment, also the Niagara.

The European or *Vinifera* grape has been grown in the East. It may be well for home use, but whether it can be made a

source of profit is another question. The **Muscat of Alexandria** is used, also other varieties and *Vitis riparia* for stock. The European variety may be grafted on the native stock, close to the root, but not so close to the ground that the graft may take root itself.

Inarching may be the method, if desired. The vines of each variety are grown near together. Each vine is cut to about



TRAINED GRAPEVINE IN CALIFORNIA

—Cal. Ag. Exp. Sta.

a third of its depth, near the ground and tied together, their cambium layers touching. The canes in the top of each plant are broken sufficiently to check growth. When the two canes grow together the top is cut off the native grape and the root from the European. In the autumn, before the ground freezes, the vines are laid on the ground and covered with six inches of earth.

As the vines grow upright, the renewal spurs are fastened to the lower wire of the trellis and the shoots run perpendicularly

or upright. The tops are allowed to grow about four inches above the trellis and are then pinched off.

The Mission grape, a *vinifera*, has long been grown in California for a dessert and wine grape. It has spread southward and is now grown in Texas. The Muscat of Alexandria is grown for raisins, and the fruit is gathered when showing 24 degrees of



LARGE MISSION GRAPE VINE

This vine is located in Carpinteria, near Santa Barbara, Cal.

sugar by the Balling test. By this test, the grape juice has the same concentration as a sugar solution of 24 per cent, as indicated by a hydrometer. The higher the percentage the better the fruit for raisin making.

Wooden trays are used for gathering the fruit. The raisins will equal from a quarter to a third of the weight of the grapes.

The trays have cleats at top and bottom to allow stacking and so there will be a three inch air space between the trays when stacked.

Sultana raisins are made from a seedless variety known as Sultana or from Sultania, also seedless. These are grown with canes six feet long, with six canes to a vine. The fruiting canes being produced from spurs from the wood of the previous year's



LOW BI-LATERAL CORDON IN CALIFORNIA

—Cal. Ag. Exp. Sta.

growth. Currants are the dried fruit of the Corinth, a small, black, seedless grape.

The varieties of grapes in California used for shipping include Chasselas Dore, Flame Tokay and Cornichon.

Pruning California Grapes.—The plants are grown like small trees from head pruning, the trunk being from 18 to 42 inches

high. They are supported by a stake until large enough to support themselves. Four to eight arms from 6 to 18 inches long, on their ends bearing two fruit spurs of the previous year's growth and three buds long. Varieties like Muscat, Zinfandel, Tokay, Malaga and others are grown in this way.

Spraying.—Grapes require spraying with Bordeaux, 4-4-50 with three pounds of arsenate of lead paste or half the quantity of powder. Two or three applications may be needed or in other localities additional applications may be required. Powdery mildew is controlled with sulphur dust and frequent dusting is required.

Laying Down Vines.—Vines subject to winter injury are protected by laying down. After the leaves drop, the vines are laid on the ground and covered with earth, cornstalks, or straw.

Bagging Fruit.—Bagging prevents birds spoiling the bunches of fruit before the crop can be harvested. Bagging improves the quality of the fruit. Two-pound Manila bags, made with a clasp for the purpose, are put over the bunches of grapes when they are about the size of peas. Ordinary paper bags can be used and fastened with a pin.

Harvesting.—Grapes are harvested when ripe, the bunches cut off with shears. The bunches are placed in trays and very carefully and gently handled.

If not shipped at once, the fruit is stored where the temperature will not go above 40° F. In cold storage grapes are usually held at 33° F., but have been kept longer at 30°.

Packing.—Climax or grape baskets are generally used in the East, ranging from 2 to 12 quarts in size. The baskets are filled so the fruit will not crush when the cover is put on, but so the fruit will be held firmly in place and not move in shipping.

Loading.—All strips on the car floor should run from one end of the car to the other and be perfectly level.

Twelve-quart Climax baskets are usually used for shipping by rail. The bottom row of baskets is placed lengthwise from one end of the car to the other and each succeeding row and layer is placed in the same way. The bottom of the baskets on the upper layer, fitting between the handles of the lower tier of baskets. If possible have no basket placed crosswise.

Where the space for the last row is wider than the baskets, the baskets are turned diagonally to fill the space. Packed carefully and properly, so there will be no movement of baskets, six tiers may be shipped safely, possibly seven.

Yield—Two and one-half tons per acre may be considered a fair yield. Higher yields have been obtained, but this is a fair average for New York.

Cane pruning consists of four arms from the top of the tree like trunk, each arm about a foot long, arranged in a semi-circle form along the trellis wire. A fruiting cane bearing ten to twenty buds and 3 to 5 feet long is left on the end of each arm. Below each arm a renewal spur of one or two buds is left, which supplies the next season's cane.

The trellis to support the vines is made of No. 12 wire, about three feet from the ground, with a second strand a foot higher, permitting sunlight to the renewals.

Sultana, Sultanina, Concord, Catawba and others are grown in this manner.

Cordon pruning consists of a long trunk grown on a wire about 3 feet from the ground. From this upright branches a foot long are grown about a foot apart, and spurs are grown on these. This system is used for the large dessert grapes.

Shipping grapes are given plenty of room so the bunches may fully develop and color well and be kept off the ground. Some

fruit is thinned by removing a quarter to a third of the grapes from the bunches. The branchlets of the bunches are removed from the more compact side of the bunch, with grape scissors.

LEADING VARIETIES OF GRAPES

Agawam.—Purplish red, large oval berries. Bunches large. Sweet and rich. Keeps well. Ripens after Concord.

Barry.—Ripens after Concord. Keeps well. A good black grape for home use. Vigorous, hardy and productive. Flowers sterile. Needs pollinizer.

Beta.—Originated in Minnesota. A cross between Carver and Concord. Very hardy, productive with fruit of fair quality. Early. Thrives in Minnesota and Wisconsin.

A variety by the same name originated in London, Ontario, is not large or attractive.

Brighton.—Red. Earlier than Concord. Vine strong grower, and productive. Good for home use. Flowers sterile; Needs a pollinizer.

Caco.—A new variety; a hybrid of Catawba and Concord. Not mentioned by Dr. Hedrick, as this variety was introduced after that work was completed. It is a red or amber fruit. The vines are strong and vigorous.

The fruit is large, in handsome complete bunches. The flavor is sweet and distinctive. This variety is too new to give a decided opinion on. It can be eaten two weeks before it is fully ripe. Ripens in New York early in September. Vines seem to be quite free from disease.

Campbell Early.—Large, dark purple fruit with small seeds, rich, sweet flavor. Two weeks earlier than Concord. Hardy and productive, but is particular as to soils; not productive on some.

Catawba.—Red. One of the best keepers. Berries and bunches of medium size and of excellent quality. Vines vigorous, hardy and productive. Fruit ripens late.

Concord.—Blue-black. The leading American commercial variety and for home use, particularly valuable North. Hardy, productive and healthy. Blooms late and seldom suffers from spring frosts. Used almost exclusively for making grape juice.

Delaware.—Red. Fruit is small, in compact bunches, keeping and shipping well. Ripens before Concord. Vines hardy, healthy and productive. Flavor is excellent. Fruit always in demand. Delaware and Concord should be included in every home garden

Diamond.—Green or white. The best white grape for the home garden. Early, hardy, vigorous and productive. Fine for home use. Excellent quality; few seeds.

Empire State.—Green. Ripens ahead of Niagara. Good quality and good shipper. Vine vigorous, productive and free from disease. Good size bunches and berries.

Herbemont.—Red-black. The important commercial variety of the South. Grown from Virginia to Texas. Will not stand zero temperature. Requires well drained, warm soil, well

supplied with humus. Also widely grown in Europe. Vine vigorous and productive. Fruit is rich, sweet and tender. Known by various names such as Brown French, Hunt, Neil, Warren, etc.

Ionia.—Red. An old variety and one of the best for training against a wall. Later than Concord and fruit keeps well. Needs protection over winter in New York.

Isabella.—This was one of the first improved American grapes. Ripens late. Keeps well. Has been generally displaced by Concord.

Jewell.—Black. Resembles its parent, the Delaware in general characteristics. Can be grown in the North where Concord fails to ripen.

King.—Black. Resembles its parent, Concord. Ripens between Worden and Concord. Berry larger and bunch more compact than Concord, with fewer seeds. Berry too large and bunch too compact for long distance shipping, but good for local, high priced trade or home use. Flavor excellent, somewhat similar to Concord.

Lenoir.—Black. A Southern grape. Good quality fruit, but berries are small. Vines vigorous.

Lindley.—Red. Berries medium to large; tender, sweet. Bunches medium size. Vines vigorous, but plants require care. Flowers sterile. Needs a pollinizer.

Lucile.—Red. Good where an extra hardy grape is required or for localities having a short season. As productive as

Concord. Bunches and berries are large. Early. Quality good. Has a foxy flavor and is somewhat seedy. Ripens ahead of Concord. Vines are unusually hardy.

Manito.—Black. Early. Originated in the South, the originator claiming it endures extremes of climate and is therefore suitable for the South and North.

McKinley Early.—White. A new variety described by the introducer as being a strong grower, with large, compact bunches of good sized berries. Green at first turning yellow when fully ripe.

McPike.—Black. Berries are of extra large size but it is not as high in quality as Worden or as productive as Concord. Vines vigorous, hardy and productive.

Moore Early.—Black. The best early black commercial grape, ripening well ahead of Concord. Vines vigorous, hardy and moderately productive. Bunch and berry medium to large. Fair to good in quality. Particularly adapted to Canada and the North, and does well also in the South. Requires rich, well drained soil.

Niagara.—Green or white. The standard white commercial grape of the East. Bunch and berries large and compact, greenish white changing to pale yellow when fully ripe. A rampant grower—good for arbors. Vines vigorous, hardy and productive. Ripens with Concord.

Salem.—Red. Berries large, bunches medium to large, of high quality. Ripens before Concord. Keeps and ships well. Vines hardy and moderately vigorous. Flowers sterile. Need a pollinizer.

Scuppernong.—A Southern grape, not hardy North. The true Scuppernong is green, but other varieties are commonly called by this name. Used largely for wine making.

Triumph.—Green. Suitable for the South and Southwest. A very fine dessert grape. Ripens with Catawba. Berries large. Vine vigorous and productive.

Worden.—Black. A Concord seedling. Berries and bunches larger than those of the parent and fruit of better quality but the fruit does not keep or ship well. Good for nearby markets and home use. Ripens ahead of Concord. Vines vigorous, hardy and productive.

Wyoming.—Red. Brisk, sweet flavor, good sized berries and bunches. Early. Vines hardy, healthy, productive, but quality is not particularly good. Flowers sterile.

VINIFERA GRAPES

The Vinifera grapes are grown commercially on the Pacific Coast, and in the East under glass. They may be grown in the open ground in the East if topworked on American varieties and the vines laid down and covered for winter. This has been done successfully at the New York State Experiment Station at Geneva.

The leading varieties are:

Alexandria, or Muscat of Alexandria, the leading table and raisin grape of California. Long, loose bunches of light yellow berries.

Black Hamburg.—A standard black grape, beautiful in appearance and delicious in flavor. Large berries and bunches.

Very high quality. Used for wine and raisins. Cannot be grown outdoors in the East.

Flame Tokay or Tokay.—Most largely grown on Pacific Coast for shipping. Berries are red with thick skin of fine quality. The bunches sometimes weigh 8 or 9 pounds. Commonly seen in eastern markets from early September until into the winter.

Malaga.—Yellowish green. Formerly this variety was largely imported from Spain, but has been prohibited. A good table and raisin grape and an excellent shipper. Our supply must now be grown in this country. Fine quality.

Muscat Hamburg.—Large dark red berries, juicy and tender, sweet and rich. Large bunches.

Sultana, Thompson's Seedless.—Largely grown commercially for seedless raisins. The bunches are large, with medium size berries. Good quality. The fresh fruit is now shipped East, arriving early and meeting with a good sale.

*Chapter XXXIII***BLACKBERRIES**

Blackberries are native of this country and grow wild in many sections. Our first cultivated varieties were wild plants, put into the garden and cultivated. One of the first commercial varieties to attract attention was an extra prolific bush bearing large fruit, found growing wild, which was cultivated and propagated and offered for sale as an improvement, which it was over the wild plants usually found.

Blackberries are grown quite generally over the whole country, so climate need hardly be considered, except in regard to some varieties.

Soil.—Blackberries can be grown on a variety of soils. The best results are obtained on good loam or clay loam where drainage is good. Too rich soils lead to plant growth at expense of fruit production. Want of moisture results in small fruit. Wet lands are unfavorable.

Planting may be done either in the spring or autumn. On heavy land, autumn set plants should be mulched as soon as the ground freezes solid, to prevent heaving of the plants by thawing and freezing. The mulch may be straw, manure, marsh hay or similar material.

The plants are set in rows eight feet apart; and six to eight feet apart in the rows.

Pruning Before Setting.—Before setting the plants, cut down the tops to six inches in height and carefully prune off broken roots. Always use a sharp knife in pruning. The plants are then placed in pails or tubs of water, hauled to the field and planted, setting them a little deeper than they were before. Tramp the soil well about the roots.

The New York State Agricultural Experiment Station has made a list of blackberries according to their degree of hardiness.

Hardy varieties, those which are not injured more than twenty-five per cent in winter are classed as hardy and include the following:

Agawam	Eldorado	Ohmer	Taylor
Ancient Briton	Fruitland	Snyder	Tyler
Chautauqua	New Rochelle	Stone Hardy	Wachusett

Tender varieties of which more than twenty-five per cent are lost by winter killing at the station at Geneva, N. Y., are as follows:

Allen	Clifton	Florence	Rathbun
Black Chief	Dorchester	Ida	Reyner
Bow Cane	Early Harvest	Kittatinny	Success
Child's Tree	Early King	Lovett	Wilson Jr.
Clark	Early Mammoth	Mesereau	

The loss in some cases was up to ninety per cent.

Cultivation.—Constant tillage is needed, particularly in dry seasons. The cultivation must be shallow. Deep tillage is injurious and promotes suckers. No weeds should be allowed to grow, but the plants should not be disturbed when in bloom.

Pruning.—Some varieties are naturally very tall, others are smaller. The first year the canes are permitted to grow about 30 to 36 inches, according to variety and character and then the stems are cut back a few inches. The object is to keep the stems strong and upright. Where the canes must be laid down and covered for winter, pruning is done before laying them over.

As soon as the plants are through fruiting the old canes should be cut out to throw the whole strength of the root into the new canes which are forming and which are to bear the crop the next year.

Tipping.—The young canes should be pinched back when they reach the proper height so no further pruning will be necessary. This should be done as often as necessary so none of the plants will exceed their proper height.

The success of the next year's crop depends on this timely work.

Thinning.—In the spring the lateral branches can be cut back to about eighteen inches, depending on the quantity of buds they carry. This is a simple method of thinning to produce large fruit. Some varieties produce their buds and fruits near the ends of the branches, so these varieties must not be pruned or much of the crop will be lost.

Staking and Training.—In home gardens the plants are usually staked and also in some commercial plantings. Trellises are also used. Galvanized wire is fastened to posts placed near enough to support the weight of the plants. The posts should be 4 feet above ground with one wire on top and the other half way down the post. Various forms are used. Cross arms can be nailed to the posts and wires run along each side of the plants. Growers use their ingenuity in forming trellises to their liking.

Fertilizing.—Care is necessary in fertilizing blackberries. Too much stable manure may have the wrong effect, causing too much plant growth at the expense of fruit and keeping the plants growing too late in the season. A small amount of phosphoric acid and potash may be beneficial. On light, sandy soils, nitrate may be helpful after the plants have flowered. Lime may be used to advantage if the soil is sour.

Harvesting.—For home use, blackberries should not be picked until ripe, but for shipping they must be picked earlier. Picking is done in quart boxes and these are shipped as filled, keeping them covered in the meantime. The berries become bitter if allowed to remain in the sun.

Blackberries frequently yield 1,000 quarts to the acre. This is only considered a fair yield. On the Pacific Coast double this figure and more is common.

The quart baskets are packed in 32 quart shipping cases and sent to market.

Propagation.—New plants are produced from suckers which spring from the roots. Suckers must be treated as weeds, as they weaken the old plants, and if new plants are wanted the suckers are planted instead of being destroyed. Some varieties do not produce many suckers. These are propagated by digging strong plants in the spring and cutting the roots into lengths of 2 or 3 inches. These are planted in a carefully prepared bed, as for a seed bed, covering them 3 inches deep and setting the cuttings a couple of inches apart.

The root cuttings may be made in the autumn and stratified or packed in sand to callus. These will make a quicker and more vigorous growth when planted the following spring and should be planted much farther apart.

LEADING VARIETIES OF BLACK- BERRIES

The leading eastern varieties of blackberries are Blowers, Early Harvest, Eldorado, Erie, Lawton, Mesereau, Minnie-waska, Rathbun, Snyder, Wilson's Early.

Ancient Briton.—Medium size fruit, sweet; hardy, productive; mid-season. Popular in Central States.

Blowers.—A large, clean, bright berry of good quality. A good shipper. Middle of July into August. Bushes, upright, hardy and productive.

Early Harvest.—Not entirely hardy North. Early and ships well. Compact grower and heavy bearer. Fruit medium sized of good quality. Largely grown in the South and on Pacific Coast.

Eldorado.—Early to medium season. Hardy and productive. Large jet black berries borne in clusters; sweet and melting. Fine for home or market.

Erie.—A good market berry for mild climates. Winter kills North.

Evergreen.—A late variety of merit grown on the Pacific Coast.

Himalaya proved a failure in the Northeast; not sufficiently hardy. A productive variety where it can be grown.

Joy.—Large black fruit of good flavor. Hardy and productive. Mid-season.

Mesereau.—A strong, upright grower; very productive. Large, brilliant blackberries of good quality, sweet, rich; little or no core. Mid-season.

Minnewaska.—Strong upright grower and very productive of large sweet berries without core. Early. Some claim it hardy and others that it winter kills.

New Rochelle seems to be the old Lawton. Hardy and vigorous.

Rathbun.—Strong erect grower, branches freely and roots from tip of branches like a black raspberry. Abundant bearer. Fruit is sweet and of good flavor, with small seeds. Ships well. Only proved semi-hardy at N. Y. Experiment Station, although nurserymen claim it has stood 20 degrees below zero without injury.

Snyder.—The fruit is of medium size, juicy, sweet and melting. Possibly the hardiest of all. Should be tried in cold sections where other varieties will not grow.

Wilson.—A large berry of good quality. In Southern New Jersey and South does well.

Chapter XXXIV

DEWBERRY AND LOGANBERRY

The Dewberry has only recently attracted much attention. At a meeting of the Fruit Growers' Society of Western New York, June 24, 1863, James Vick described the dewberries grown by Dr. Miner, of Honeoye Falls, N. Y., and his method of cultivating and training them, tying the fruiting canes to stakes five feet high and allowing the new growth to ramble. Two varieties were grown, but likely these were never named or distributed. Bartel was the first named variety introduced. But as late as 1880, no dewberries are listed in nurserymen's catalogues. Lucretia was not introduced until 1886. Wilson's Early and Wilson Jr. blackberries seem to be intermediate between the blackberry and dewberry. Dewberries differ from blackberries by their trailing form of growth and their early ripening.

Propagation.—Dewberries are propagated by roots which form at the tips of the stems when they are covered with earth, and some blackberries may also be propagated in this manner.

Dewberries may also be propagated by root cuttings about five inches long, and handled the same as blackberries, but tip plants are produced with less trouble.

Planting.—Sandy loam is preferred by dewberries. If to be grown on a trellis, they are planted three feet apart and the rows set about six feet apart. If grown naturally, without support, set the plants six feet apart, first removing the tops, leaving stems about six inches long. Rows of a different variety should be planted every third or fourth row as pollenizers.

The culture of the dewberry is the same as the blackberry, except that the dewberry may be given a dressing of stable manure after cold weather arrives in the autumn or it may be applied in the spring.

The pruning system used in the West is to prune when the new canes are a little more than a foot high, to encourage lateral growth. The old canes are removed in the spring. In sections where irrigation is used, the plants are watered regularly from the time active growth starts and continued until after harvest. The fruit is picked as soon as ripe, later the color fades. Dewberries are too soft to ship.

Lucretia is a tall growing variety best suited to the North. Healthy and productive. The fruit is large and sweet and ripens early. Requires protecting in winter in New York.

Atlantic.—Ripens late.

Bartel.—Large, rich and juicy.

Mayes.—A popular variety West and South. Somewhat grown in the East.

McDonald.—Another Western sort. Mayes or Lucretia should be planted with McDonald.

LOGANBERRY

The Loganberry was a seedling produced by J. H. Logan of Santa Cruz, California, in 1882. Wild plants similar are found in Vancouver Island and in several of the Pacific States.

The Loganberry is largely grown in the West and in England, but it is not suitable for culture in the East. The plants are propagated from the tips, the same as dewberries. The vines are grown on trellises. The fruit is picked when firm for shipping. The old canes are cut off as soon as the crop is harvested.



PICKING CARRIER

Holds two oblong pint baskets.—U. S. D. A.



FRUIT CLUSTER OF CUMBERLAND BLACK RASPBERRY
—U. S. D. A.

*Chapter XXXV***RASPBERRY**

The native red raspberry has been in cultivation much longer than the black raspberry or the blackberry. The European red raspberry was for some time cultivated here, but has been displaced by our more hardy native varieties or hybrids.

Cuthbert is the leading red variety, Marlboro the favorite in some localities. In the hybrid class Columbia and Shafer are leaders.

Raspberries are grown quite generally over the country, principally in the East, West and Middle States.

Black raspberries or black-caps are of more recent introduction. The first variety to attract attention was the Ohio Ever-bearing, which Nicholas Longworth of Cincinnati called attention to about 1832-3.

The black raspberry has a very distinct and delicious flavor. No berry makes such delightfully flavored pies. As a fresh fruit it is excellent. The drawback to black raspberries is the too numerous seeds which they contain.

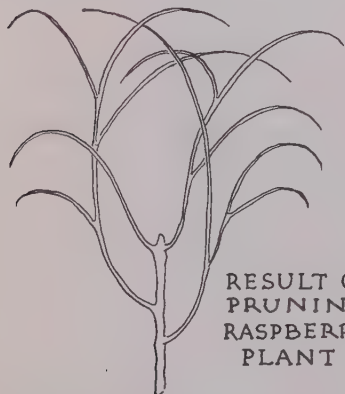
Soil.—Black raspberries grow successfully on a variety of soils. If there is any preference it is for a good, deep soil with good drainage, but plenty of moisture is needed to produce maximum crops. Red raspberries also thrive on a variety of soils. Good loam or even light soil suits them. They also need ample moisture when setting fruit. Red raspberries are hardier than the black.

Planting.—Planting may be done in spring or autumn. Spring is considered best for the black-caps, setting the plants

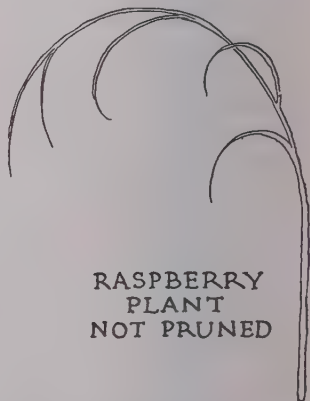
as early as possible. Autumn set plants, in cold sections, should have the soil drawn up well about them and when the ground has frozen, mulch with straw, marsh hay or other material to prevent thawing and freezing heaving the plants. The tops should be cut back to about six inches and the plants set only a trifle lower than before. Keep the roots wet until the plants are set.

Red raspberry suckers, if not over 6 or 8 inches high, can be dug and transplanted on a rainy day when in foliage.

Set the plants 3 to 4 feet apart in the row and the rows 6 feet apart.



RESULT OF
PRUNING
RASPBERRY
PLANT



RASPBERRY
PLANT
NOT PRUNED

Cultivation.—Cultivate very shallowly but constantly during the growing season, keeping down all suckers except those desired for planting elsewhere.

Pruning.—Cut out the old canes as soon as the crop is harvested and any new canes not wanted can be removed the next spring. The custom is to leave from four to six canes. These are pruned back to about five feet in the spring.

Black raspberries are pinched back when the canes are about three feet high. Thinning is accomplished by pruning the lateral branches back, taking off about a third of the growth.

Harvesting.—Red raspberries are picked in pint cups, when they are still firm but ripe. Never pick when wet. Raspberries



CUTHBERT RED RASPBERRIES PLANTED WITH THE
HEGE SYSTEM

Canes pruned back in spring so they will support the fruit.—U. S. D. A.

are soft and must be handled very carefully. They are shipped in pint baskets. Black raspberries either in pint or quart baskets.

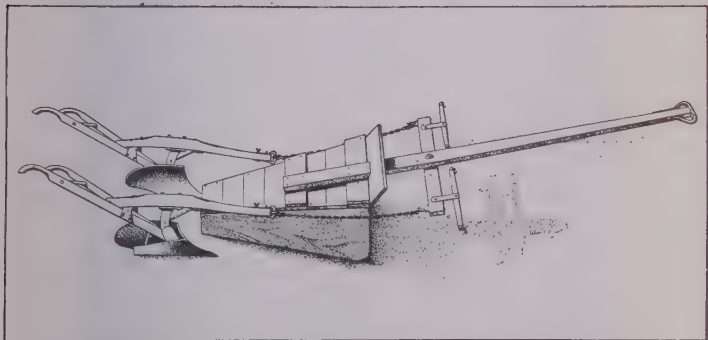
Black raspberries for evaporating are collected with a harvester. This is a large canvas tray three feet square, fastened to a wooden frame, supported by a shoe or box at the bottom on which it is slid along the ground from bush to bush. A hook is carried in the left hand to draw the stems over the tray and a canvas paddle, stretched over heavy wire, is held in the right hand, with which the berries are beaten off into the tray. The berries are gathered when fully ripe so they fall



RED RASPBERRY PLANTED IN HILL SYSTEM
Seven bearing canes tied to a single stake.—U. S. D. A.

easily from the plants. The fruit is placed in trays and as it stands the insects escape. It may be necessary to go over the patch several times to gather all the fruit. 1,500 to 2,000 quarts to the acre is a fair average for red raspberries and somewhat higher for black raspberries.

Marketing.—Red raspberries are shipped in crates of 16 or 24 pints. Black raspberries are shipped usually in crates of 24



IMPLEMENT FOR COVERING RASPBERRY CANES

For winter protection. The horses pass one on each side of the row.
—U. S. D. A.

or 32 quarts, the same as strawberries. The black are firmer and ship better.

Raspberries are used for drying, canning, jam, jelly, for juice and beverages.

Propagation.—Red raspberries are obtained from suckers, with a good piece of root. Black raspberries and the purple varieties, such as Columbian, root from tips of the canes. In August, bend the tip down and cover with about three inches of soil. Tip plants are best from plants not more than three years old.



WOODEN SUPPORT

With two wires to hold the bearing and young canes upright.—U. S. D. A.

LEADING VARIETIES OF RASPBERRIES

Card gives a list of 315 varieties of red and hybrid raspberries. Only a few are important either commercially or in the home garden. Many listed by Card are probably now extinct.

Brilliant.—Mid-season comes in before Cuthbert. Bright glossy red. Ripens evenly. Not of high flavor. Largely grown in Southern New Jersey. Not hardy North. Red.

Cardinal.—This is a hybrid or a purple raspberry. Fruits large, but soft and juicy. Propagated by tips or suckers. Does well in the Central West and farther South than Columbian. May also be grown in the North.

Cayuga.—Produced by the N. Y. Agri. Exp. Station. Hardy and more productive than Cuthbert. Fruit resembles Cuthbert, but is not so seedy and earlier than that variety. A cross between June and Cuthbert.

Columbian.—The most productive of the purple varieties and in fact the most productive raspberry. Fruit large, juicy, sweet and fairly firm. Firmer and larger than Shafer, ripening a little later. It is the best raspberry for canning. Plants tall, spreading and vigorous.

Cumberland.—Mid-season black. Large, firm fruit of good quality. Productive. A healthy, vigorous grower.

Cuthbert.—Red. Also known by various other names such as Conover, Queen of the Market, etc. Mid-season to late. Fruit large, juicy, firm, of good quality. Color is dark. The leading main crop market variety.

Empire.—Color about same as Cuthbert, Hardy, vigorous and productive. Fruit larger than Cuthbert, ripening earlier, having a longer picking season. Rich, sweet, firm and of good quality.

Golden Queen.—Yellow, larger than Cuthbert. Fruit of fine flavor, good size, and good quality, but soft. Excellent for home use. Canes hardy, strong and productive.

Gregg.—Black. Large, firm berries of good quality. Strong grower, but not very hardy. For years this has been a leading market variety—but is being superseded by other varieties.

Herbert.—Red. Mid-season. Originated in Canada and is very hardy, possibly the hardiest. Fruit is bright red, larger than Cuthbert, sweet and juicy, but softer than Cuthbert.

Japanese Golden Mayberry.—Yellow. This is one of Luther Burbank's productions. Said to be the earliest of all raspberries. It has not been sufficiently tested in the East to say what it will do here.

June.—Red. The earliest of all the varieties that have been tested in the East. Originated by N. Y. Agricultural Experiment Station. A cross between Ludon and Marlboro. Plants tall, vigorous, upright, spreading; hardy and productive, without thorns. Ripens early and fruits over a long season. Fruit firm, tender, juicy and good.

Kansas.—Black. A strong, vigorous grower, standing drought, bearing heavily. Early. The fruit is the size of Gregg but of better color; jet black, almost free from bloom, firm and of good quality. Winter kills somewhat, in cold regions.

King.—Red. Also known as Thompson's King. Early. Fruit of good color. Not of excellent flavor, but good. Plants tall, vigorous and productive, hardy. Grown in West Virginia and West, through the Central West, where it is considered one of the best early varieties.

Latham.—Originated at Minnesota State Fruit Breeding Farm. Plants tall, vigorous and hardy, growing well in Minnesota; productive, withstanding drought. Berries are large and in fruit over a long season, juicy, firm and good. Does best on clay soil.

Loudon.—Red. Originated in Wisconsin. Plants are hardy, vigorous and productive. Fruit is large, juicy, firm and good. Thrives on light soil but bears best on clayey loam.

Marlboro.—Red. Early. Plants vigorous, productive and hardy. Fruit large, of good flavor and firm. The best well-tested, large, early berry of the North.

Marldon.—Red. Another production of the N. Y. Agri. Exp. Station. Plants are of Marlboro type, but more vigorous and stockier, producing suckers rapidly. Hardy, productive and healthy. Fruit large, but ripens over a short season. About a week ahead of Cuthbert; firm and of fair quality.

Ohio.—Black. The leading variety for drying. Flesh firm and dry. Fruit small, very firm, seedy, sweet, of good quality. Plants vigorous and hardy.

Ontario Red.—Very productive. Precedes Cuthbert. Fruit large, handsome, of good flavor and quality and ships well. Plants tall and vigorous.

Owasco.—Red. Fruits large and handsome; mid-season; ships and keeps well, juicy, firm, sweet, highly flavored, good. Plants do not sucker much. Hardy in the berry regions of New York. A cross between June and Cuthbert.

Plum Farmer.—Black. Early. One of the most profitable early market varieties. The fruit is large, thick meated, firm, attractive, covered with bloom like the bloom on a grape. A good commercial variety.

Ranere or St. Regis.—Red. Everbearing. Ripens a crop in the autumn on canes grown the same year. Suitable for home use.

Redpath.—Originated in Minnesota. Hardy, vigorous and productive. Fruit large and of good quality.

Scarff.—Black. Vigorous and productive. Fruit large and of good quality. Early.

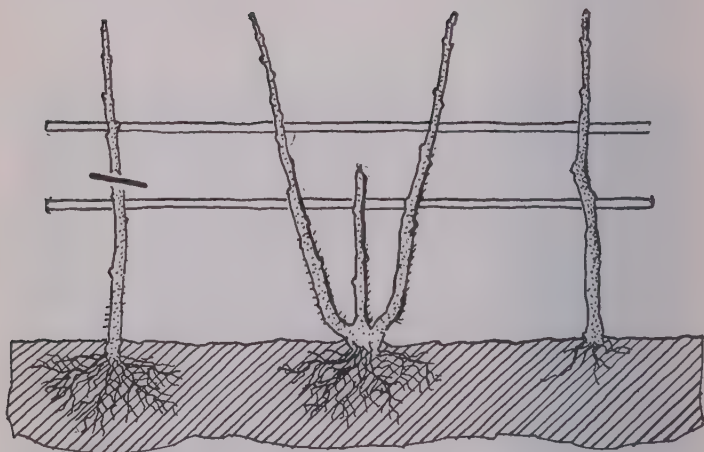
Sunbeam.—Red. Originated in South Dakota. The only one from a lot of several thousand seedlings that seemed suitable for the great plains. Vigorous, hardy and upright in growth. Fruit firm and of good quality.

Superlative.—A European variety introduced by Ellwanger and Barry of Rochester, N. Y., and described as hardy. Fruit large, handsome and of fine flavor. In the East it seems to be suitable only for home use and not hardy in the Northeast, but it is largely grown on the Pacific Coast.

Syracuse.—Red. Late. Plants medium in vigor but not fully hardy. Fruit is large, light red, sweet and good, but not very firm.



RED RASPBERRIES TRAINED TO SINGLE WIRE TRELLIS
Under the linear system. The bearing canes are tied to the wire to hold them erect.—U. S. D. A.



Well ripened cane for planting. Cut back to black line when planting.

Cutting back causes vigorous new growth to start in the spring.

Large canes with few roots are undesirable for planting.

Chapter XXXVI

CURRANTS AND GOOSEBERRIES

Currants are grown generally throughout the United States and in parts of Canada. New York produces more currants than any other state.

The currant thrives in a variety of soils, so long as the drainage is good. Ample moisture is needed for good sized fruit and abundant crops. Slightly acid soil does not seem to be objectionable to this plant. The variety grown should be one suited to local conditions.

Planting.—The land should be plowed deeply, turning under a good application of manure, if possible. For home gardens currants may be planted 4 by 4 feet apart, though 6 by 6 feet is the usual distance in commercial plantations. Planting may be done in the spring or autumn using strong one or two year old plants, and in planting, set the plants deeply and firm the soil well about the roots. The ground should be kept free from all grass and weeds and for the first two years a crop may be grown between the rows, the cultivating of which will keep the land in good condition. Spring planting should be done as early as possible and autumn planting as soon as the leaves fall.

Frequent shallow cultivation should be given, beginning in the early spring and continuing until the fruit is picked and this should not be neglected in any season.

Start a cover crop of oats or other crops as soon as the last cultivation is given, working it in, in the spring with a disk harrow. If the plants are likely to be laid low by the weight of heavy snow, tie them up late in the autumn. Otherwise the sprawling plants over the ground will interfere with cultivation.

Little pruning is given red and white currants until five years after planting. Then the bushes are thinned by removing any unwanted old canes, leaving eight or nine strong canes. In pruning, take off the canes that sprawl on the ground, keeping the plants upright for convenience in cultivating and harvesting the crop.

Black currants differ from red in the fact that the black varieties bear their fruit on wood of the previous year's growth. As soon as the crop is harvested, cut out enough old canes to encourage a vigorous new growth to supply the next season's crop.

Spraying.—Currants should be sprayed with lime-sulphur if there is scale, as there is almost sure to be. This spray should be given when the plants are dormant, but not in freezing weather. As soon as the fruit is well formed, give a spraying of Bordeaux and arsenate of lead, which will keep the currant worms in check. Repeat this spray as soon as the crop is gathered, to protect the foliage. See that the spray covers both the upper and under side of the foliage.

Currants begin bearing when three years old, but are not in full bearing until five years old.

Harvesting.—For market, the fruit must be carefully picked with the stems on, when it is not overripe, but firm. Only pick when the fruit is dry. Three tons per acre is a good yield, but double this is produced by some growers. The fruit for market is picked in quart baskets and shipped in a 32 quart crate. For canners the picking is in 8 lb. grape baskets.

Currants do not keep long in cold storage. They keep best in a dry, warm atmosphere, with good ventilation. The fruit is best moved promptly.

Currants are rank feeders and need a rich soil and liberal fertilizing for good results. Stable manure, poultry droppings and high analysis complete fertilizers may be used. The land should be kept well up in humus, by turning under green crops or applications of manure. Mulching the plants during summer is beneficial. Currants will live and produce fruit when given very little attention, but good results can be had only by giving the plants proper care.

Propagation.—Currants are readily propagated from hardwood cuttings, made from well ripened wood of one season's growth, after the foliage has dropped in the autumn. Make the cuttings 7 to 8 inches long and plant them at once, a little more than half their length under ground. Cover the rows with straw or other light mulch. The cuttings can be made and planted in the spring, or if made in the autumn they can be tied in small bundles and planted upside down in the open ground with two or three inches of soil over them. Here they will callus and sometimes form roots even before winter, or by spring. If left until spring, give additional covering before freezing weather. Spring planting of the cuttings must be done early.

The cuttings can be buried in sand over winter in a cool cellar if that is desired.

Make the cuttings with the base just below a bud, making a smooth, clean cut with a sharp knife. The top is cut slanting an inch or two above a bud.

New varieties are grown from seed. The berries are crushed when ripe and the seed washed from the pulp and dried and planted in the spring. Or the seed can be mixed at once with moist sand and not allowed to dry until planted in the spring. Sow half an inch deep in the open ground and mulch lightly to keep the soil moist. The seeds start quickly under glass in the spring.

Experienced growers replant the beds after eight or ten years, but with good care, properly fertilizing and pruning, bushes may be kept in good bearing condition for years.

In some countries the leaves of black currants are dried and used for making "tea," said to resemble green tea in flavor.

LEADING VARIETIES OF CURRANTS

Hedrick gives a list of seventy black currants and one hundred and thirteen red and white varieties. Only a few varieties are of commercial importance.

Red Varieties

Cherry.—Large berries on short clusters; a robust fruitful variety. Vigorous, stocky bushes. Berries have thin skins; flavor good.

Diploma.—Fruit large, light red, sweet, juicy and solid. Large clusters. Very productive. Medium late.

Fay or Fay's Prolific.—Berries of good size; flavor good. Long stemmed clusters.

Perfection.—A cross between Fay and White Grape. Has the characteristics of both parents. Berries are large, less acid than others and have few seeds. Clusters large. Vigorous bush. Mid-season.

Pomona.—Medium size. Good quality. Hangs well after ripening.

Wilder.—Large bright red berries and good size clusters. Mild flavor. Bush upright and vigorous. Late mid-season. A good commercial variety or for home use.

White Varieties

White Grape.—Known by many other names. Large, sweet berry, or very mild acid. Prolific.

White Imperial.—Fruit large and sweet. Vigorous grower; productive.

Black Currant Varieties

Nurserymen in some states are not growing black currants now, owing to various quarantines on account of the white pine blister rust, which is supposed to winter on this plant.

Booskoop Giant.—Vigorous and productive. Fruit large, clusters long.

Champion.—Plants somewhat dwarf in habit, but productive. Fruit large; mild.

GOOSEBERRIES

Gooseberries belong to the same botanical family as the currant and like a cool moist climate, a rather rich, heavy, but well drained soil, although ample moisture is also needed. The gooseberry, like the currant, does not seem to object to slightly acid soil.

The gooseberry also like the currant is a northern plant, and more than the currant dislikes a hot climate. My plants in the vicinity of Newark, New Jersey, do well in heavy, rich soil, well drained, fully exposed, given plenty of moisture with the hose during hot, dry weather. The plants are heavy feeders and cow manure and stable manure can be used to advantage. Plenty of humus should be kept in the soil. Mulching with lawn clippings in summer is beneficial. Peat moss is a good mulch and may be worked in the soil to form humus.

The gooseberry is planted like the currant and at the same season. For commercial planting the rows may be six feet apart and the plants four feet apart in the rows. In the home garden four feet apart is sufficient.

Cultivation should be quite like the currant, frequent and shallow. Deep cultivation may be injurious.

The best fruits are produced on one-year old branches. After two years they should be removed, allowing only such wood to remain as the bush is able to support. In the North, an open top bush is desirable. Where the summers are hot a more compact growth is best.

Gooseberries for table use are best when ripened on the bush, but for market they are picked green and hard. The bushes are thorny and picking is done with leather gloves to save the hands. Some commercial growers strip the bushes with thick gloves and then put the berries through a fanning mill to remove the leaves.

The green fruit can be safely shipped long distances. Both the quart basket and the 10 lb. grape basket are used for market.

Gooseberries make fine jam and jelly and when fully ripened on the bush are a pleasing dessert fruit, being especially desirable in fruit salads.

It is said that gooseberries can be preserved in a very simple manner, by simply filling a clean fruit jar with sound fruit, being careful not to use any bruised, crushed or over-ripe fruit. Then fill the jar with clean, cold water, fasten the top on and store in a cool cellar.

The gooseberry is very hardy, thriving in many parts of Canada, but it does not do well South. When well cared for the beds will last for twenty years or more, though commercial growers renew the plantings in about ten years. Renewal is suggested as soon as the plants seem to be failing in production. Well grown plants in bearing should average around six to seven quarts to a plant, or possibly 300 bushels or more to the acre.

Propagation—The gooseberry is propagated quite like the currant, but it does not root so readily from cuttings. Cuttings are made from well ripened wood of the present season's growth and well mulched, if planted in the autumn. Cuttings set in the spring must be taken very early. Varieties like Downing and Houghton that do not root readily from cuttings can be started from layers, but this is a slow process. Mound layering is the most productive form of layering

The plants are severely pruned back in the autumn, which results in many new shoots starting the following spring. When these have made a good growth, about the middle of summer, soil is mounded up around them, so that only the tips are exposed.

European varieties root slowly and are left for two seasons, but American varieties will be rooted and may be removed late the same autumn, trenched in a cellar for early spring planting, or maybe planted as removed from the parent plants in the autumn. In the latter case they should be well mulched. They are cultivated for one season and then sold. The suckers are also used to make new plants.

New varieties are produced from seed as described for currants.

Spraying.—Gooseberries are likely to need a dormant spray of lime sulphur as recommended for currants. The summer spray is applied as soon as the berries are formed, 1 gallon to 40 gallons of water, with two pounds of arsenate of lead, applied again as soon as the fruit is harvested. To prevent mildew spray as soon as the leaves appear and several times during summer with potassium sulphide, one ounce to four gallons of water.

LEADING VARIETIES OF GOOSEBERRIES

American Varieties

Downing.—The most popular commercial variety. Large berries of excellent quality. Bushes are vigorous and productive. Comparatively free from mildew. Good for home gardens.

Houghton.—Bears abundantly and regularly. Fruit tender and good, but not large. Free from mildew.

Josselyn.—Berries are large and of good quality. Plants are prolific and hardy and free from mildew.

Poorman.—Medium size, reddish berries. Vigorous and productive.

Red Jacket.—Same as Josselyn. These are listed by some nurserymen as different varieties, but they seem at least to be very similar

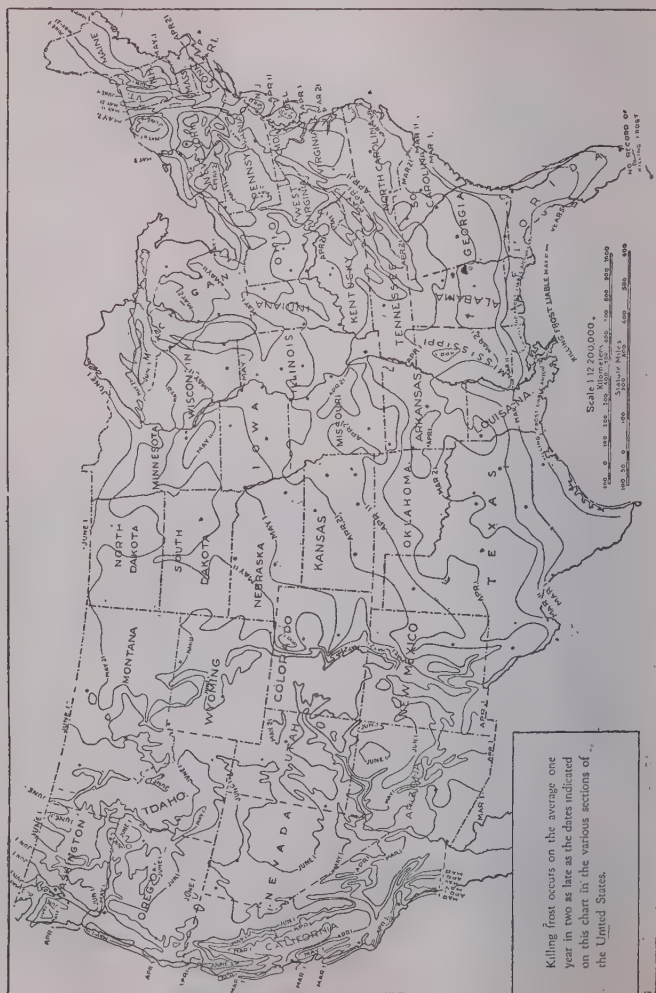
European Varieties

Chautauqua.—Known also as Triumph and Wellington Glory. Productive. Berries of good quality. Green.

Industry.—Berries are large, dark red and of excellent flavor and quality. Productive



WAIST AND HAND CARRIERS
Hand carriers hold six baskets.—U. S. D. A.



Chapter XXXVII

BLUEBERRIES

Blueberries and cranberries belong to the same family, Ericaceae, and require different culture from most other fruits.

Blueberries grow wild over a considerable portion of the country. *Vaccinium corymbosum* is the high bush or swamp blueberry growing 4 to 15 feet high. The fruit is blue-black with a bloom.

Vaccinium pennsylvanicum is the low blueberry, a dwarf shrub from 6 inches to 2 feet high, with a bluish-black berry. This variety is found on sandy soils, growing around old stumps and in the woods. It is from this species that most of the blueberries found in market are obtained.

Vaccinium vacillans is the low blueberry. The berries are large with much bloom, ripening late and of fine flavor. These are found in dry sandy or rocky places in the Northern and Central States, chiefly west of the Alleghenies.

Most of the fruit in the market is gathered wild in Maine, New Jersey and Pennsylvania.

Wild plants can be dug by taking up a sufficient ball of earth with them in the autumn and planting them in the garden; they will grow there successfully, providing the soil is properly prepared in advance. It must be free from lime and made acid, containing plenty of organic matter.

One way to do this is to gather plenty of fallen leaves in the autumn. Pile the leaves up and stir them by turning over with a pitchfork, after rains, so the pile will become wet all the way through, or pour on water. By the following spring it will be in shape to turn under. Cover the land heavily with the decayed leaves and plow or spade them under. In the autumn give another plowing or turning with the spade and the plants may be gathered and transplanted. Land that is so acid it cannot be used for other crops will grow blueberries. Good drainage is important and also that the plants have sufficient moisture.

The plants should be mulched with decayed leaves as soon as they are planted.

If it is desired to do the planting without delay, peat moss can be dug into the soil liberally in the same manner as suggested for leaves and the plants can then be set out. Mulch liberally with peat moss as soon as the plants are set.

Dr. Frederick V. Coville of the U. S. Department of Agriculture has devoted considerable time and effort to obtaining wild plants bearing large fruits and hybridizing these and producing plants from seed. He has originated varieties with very large berries on robust, productive bushes.

Eight varieties are now on the market: Adams, early; Cabot, early; Harding, mid-season; Sam, mid-season; Pioneer, mid-season; Katharine, mid-season; Rubel, late; Grover, late. These are the best varieties to grow. Space the plants three feet apart. In commercial fields the rows are set 8 feet apart and the plants 4 feet apart in the rows. The plants will bear a year after planting and produce well the third year. The plants will bear abundantly for years. At least two varieties should be included in every planting for an exchange of pollen necessary to insure good crops of berries, the plants being located not farther apart than one hundred feet.

In purchasing plants, if these varieties are wanted, it must be made plain that no other kinds will be accepted. Some nurserymen supply nursery grown plants from wild varieties. The wild plants are hardy and the fruit good, but the fruit is much smaller and more seedy than the hybrids.

Propagating.—The low blueberry spreads by root stocks and is propagated by root cuttings. Other kinds are propagated by layering and cuttings.

Cuttings.—The plants should be exposed to freezing weather before any cuttings are made, therefore cuttings are usually made in the spring. The cuttings are laid horizontally in a shallow, well drained box of clean sand and covered with a half-inch of sand. Water well and keep in a temperature of 60° to 65° F. The sand should be kept damp. In about six weeks shoots may appear through the sand, when the box may be placed in the light, but not in direct sunlight. Keep the temperature as near 65° as possible. When the first shoots cease growing and their foliage is a good green color, the plants will be ready to make roots. At that time spread half an inch of peat moss or sifted rotted peat over the sand and wet thoroughly. Keep in a nearly saturated atmosphere until new shoots no longer appear. The older shoots will have formed roots.

When well rooted the young plants will make a second twig growth and this shows that the cuttings have actually rooted. The plants may separate themselves from the parent cutting or they may be separated with a knife and kept in two inch pots in a blueberry soil, made of clean or washed sand 1 part; upland peat, rotted, 9 parts; and 3 parts broken crocks in small pieces. Loam or soil containing lime or manure are detrimental. Peat from kalmia or laurel thickets is best. Rotted oak

leaves are good. Keep the pots plunged in sand, because if the surface of the pot becomes dry, the roots are apt to be killed, as they work to the top of the soil for air.

The young plants must be shaded from the sun. Cuttings and year old plants should be placed outdoors and be well mulched with leaves, preferably oak leaves

Plants from cuttings or rooted shoots should be ready for autumn planting when two or three years old or when about $1\frac{1}{2}$ to 2 feet high. They can be planted in August and well watered or set out in spring before the buds have started.

Nurserymen who grow them, make cuttings three inches long or a trifle longer in August, as soon as the wood is sufficiently hard. The cuttings are then chilled for several days. Then they are planted 2 to 3 inches apart in a sandy, peaty soil in cold frames under shade. Imported peat moss is ideal material for mixing with the sand. The cuttings callus and growth starts in the spring. Then there is a period of rest, when roots are formed. When the roots are formed new growth starts, after which the plants are repotted with a ball of soil, in 3 inch pots, plunged in sand in a shaded cold frame and mulched with leaves over winter. They are grown for two years and then planted in August, as the roots make good growth after that time.

Layering.—In some instances the plants may be made to layer as suggested for gooseberries. The stems are cut back in the early spring, close to the ground and the plant covered over, two inches deep with a mixture of clean sand four parts and one part peat. This should be kept moist, New stems will appear and roots will develop.

The plants are moved the next spring before growth starts, The tops are cut back to three buds, potted in 3 inch pots in soil composed of one part sand and two parts rotted peat.

They are placed in a shaded cold frame which is held at 65° F, If the temperature goes too high they will rot, They must be kept moist, not wet, and not be over-heated or over-ventilated. Small twigs will appear which will become woody and from them new growth will start. The plants will then be established. They may need repotting into a larger pot in soil made up as described, clean sand 1 part, rotted upland peat 9 parts and 3 parts finely broken crocks.

To be sure to have conditions favorable, it is recommended that a trench 4 feet wide and 2 feet deep be excavated when the natural soil is unfavorable, filling this in with 3 to 4 parts of peat or rotted leaves and 1 of clean sand, planting in this. We have dug in decayed leaves of a mixture of oak, maple and some others just as gathered, covering the land four to six inches deep with this material, digging it in in the autumn. The soil was naturally heavy clay loam which had long been used for garden. Peat moss was also used and the plants flourished.

Cultivation.—Clean cultivation, but very shallow, should be given. Cultivated bushes should not be burned over. If a stem is unproductive cut it out, whether one stem or all on the bush.

Wild plants should only be moved when wholly dormant and in each case take as big a ball of earth and root as possible with the plant. Blueberries do not send out new roots in the spring until the plants are in leaf, so whatever growth is made by transplanted plants will be by the aid of the roots moved with them. Cut the top back heavily of each plant when it is moved.

The berries are sent to market in quart baskets, in 32 quart strawberry crates.

Vaccinium virgatum is the Florida blueberry. It is a vigorous shrub from 15 to 18 feet high and is planted 12 feet apart. Fruit considered equal to Northern blueberries. Season from May to August.

Fertilizer.—Experiments up to the present time show best results from the following mixture:

Nitrate of Soda.....	170 lbs.
Dried blood.....	230 “
Steamed bone.....	340 “
Phosphate rock.....	340 “
Potash.....	170 “

This fertilizer was used at the rate of 600 lbs. to the acre or an eighth of a pound to the square yard.

The surface should be sand, muck or peat, made level so the entire bog can be flooded to an equal depth. Acid soil is required and is usually found in such locations. All trees, bushes, grass and weeds should be entirely removed. Surface ditches are made to carry off the water, so constructed that when dammed up, the bog can be flooded to any desired depth and the water, lowered or carried off at will. Good drainage must be assured. The water table should be from 18 inches to 32 inches below the surface and controlled so it can be raised or lowered.

When the bog has reached this stage of development, it is covered with coarse sand to a depth of 4 inches. This must be kept free from grass and weeds. Sand is applied every two or three years, which covers the runners, producing new plants.

Chapter XXXVIII

CRANBERRIES

See information on irrigation in Guide No. 1.

The American Cranberry.—*Vaccinum macrocarpon* is the variety commercially cultivated. It will grow in gardens, in soil made acid as for blueberries. if given sufficient water to keep it from drying out. This, however, is only desirable as an interesting garden plant, which it is. In low land where proper irrigation can be given, or in swamps is where it is grown commercially. The plants have been found growing on floating bogs, held in place by conditions, but in gathering the berries one has to be very careful not to break through into quite deep water.

Cranberries are grown largely in Massachusetts, New Jersey and Wisconsin, Nova Scotia to some extent and in Oregon and Washington on the western coast. Cooperative organizations have helped the industry wonderfully in the last few years and new and improved methods of growing, grading, packing and marketing have been introduced.

The Bog.—Suitable soil, a supply of sand, ample water and equally ample drainage is necessary for commercial success. A flowing stream that can be used as wanted or diverted is not only desirable but almost necessary. The subsoil should be clay and not too far down to hold the water. Two feet is a good depth.

Planting.—Cuttings 6 or 8 inches long are used to plant the beds. A wide dibber is used in planting, making an opening in which several cuttings are placed, 9 inches apart, in rows 18 inches apart, pushed down into the good soil beneath the sand. The cuttings must not be permitted to dry out before they are planted. The planting being done, as a rule, in the spring. A crop will be produced in three years.

When the planting is completed, water is let in to moisten the soil. When the plants are ready for fruiting, water is let in on the surface on frosty nights, to prevent frost damage to the buds. It is drawn off in the morning.

The plants are closely watched in the spring when they are making new shoots, because damage at this time would mean lessening or losing the crop.

The plants bloom in July and at this time the beds are watched to see that they are not too dry. The plants, however, must not be flooded while in bloom. In dry seasons water is given once a week for only a short time and promptly drained off. Early in the winter the bog is flooded and the water permitted to remain until danger of hard spring frosts has passed, as the new shoots are injured by frost. When the water is lowered and the plants exposed, they become hardened and will withstand frost. Weedy bogs are more likely to be damaged by frosts than when kept clean.

Late in the second season a light covering of sand is applied to hold the runners down. A crop may be expected in three years.

Dams are made of wood or concrete and in Massachusetts a bog covering many acres can be flooded in about three hours and drained as quickly. There the winter water is kept on the bogs until the last of June and in New Jersey still later, to kill weeds and insects, as it is the cheapest way to control

them, although at the sacrifice of the crop that season. The plants are permitted to rest and an abundant crop is produced the next season.

Pruning.—The vines become thick and are pruned in the autumn or spring with an implement made for the purpose called a knife-rake. The vines naturally run southeast. The pruning therefore is from the northwest across the bog.

Harvesting in the East begins late in August and requires four or five weeks. The fruit is gathered before it is fully ripe, but not too early in which case it shrivels. Harvesting is done with a scoop made for the purpose. The bed is lined off with strings, each picker given a row between two strings and the bed is gone over carefully and completely.

The fruit is sent to the storehouse where leaves, damaged berries and sticks are separated from the berries, by running through a separator, somewhat resembling a fanning mill. This machine also removes decayed or soft fruit. It is then sized or graded and inspected and imperfect berries removed by hand, as it passes over belt conveyors.

Curing.—The fruit is held for a week to three months after it is harvested, in small boxes in the storage house having good ventilation throughout, so it may be kept cool and dry. The fruit cannot be packed as picked as in that case it heats and becomes diseased.

Packing.—The fruit is packed in boxes or barrels. The barrels hold one hundred pounds. The barrels are filled and racked or shaken down quite like racking apples and the head pressed in. Every barrel must be well filled and packed.

The half barrel box is popular, holding fifty pounds of berries.

After Harvesting.—Flooding the bog after harvesting is beneficial. The vines need this to aid recovery after the rough usage of scooping the fruit. All weeds are cut down before winter flooding. Some growers sand every autumn, others every second year.

The dimensions of the U. S. standard cranberry barrel are as follows: Stave length $28\frac{1}{2}$ inches; head, diameter $16\frac{1}{4}$ inches; distance between heads $25\frac{1}{4}$ inches; circumference at bulge $58\frac{1}{2}$ inches; outside measurement. The staves not more than four-tenths of an inch in thickness

Yield.—The average yield is around 2,000 quarts per acre and sometimes reaches twice that quantity.

Fertilizing seems to be a doubtful question at present. Nitrogen is used by some, complete fertilizers by others, acid phosphate and cotton seed meal are also used. Go carefully with fertilizer. Experiment in a small way and if possible find what the soil requirements of any particular bog may be.

Insects and Diseases.—Flooding the beds destroys some insects. Spraying with arsenate of lead 2 lbs. dry or double the quantity of paste to 50 gallons of water is sometimes used.

Diseases such as scald and rot cause decayed fruit. It attacks not only the fruit but flowers and leaves also. The remedy is spraying with Bordeaux 5-5-50, adding 4 lbs. rosin fish oil soap. The first application is given in June and every two weeks thereafter until five applications have been given. Good growing conditions should be given.

There are several other fungous diseases including bitter rot which require the same treatment as scald.

Red rust or galls on the stems is carried by the water. Withholding water is the remedy.

Rose bloom troubles late varieties. Flooding for three days in June as the terminal buds are ready to break, causes the death of affected buds.

Worms.—The yellow headed, black headed and cranberry fruit worm are troublesome. The fruit worm eats into the berry and causes it to fall, then leaving it for another berry. Winter flooding retained as late as possible is a help and spraying with arsenicals. The false army worm is treated in the same way. Use an oil torch on worms that get to the shore.

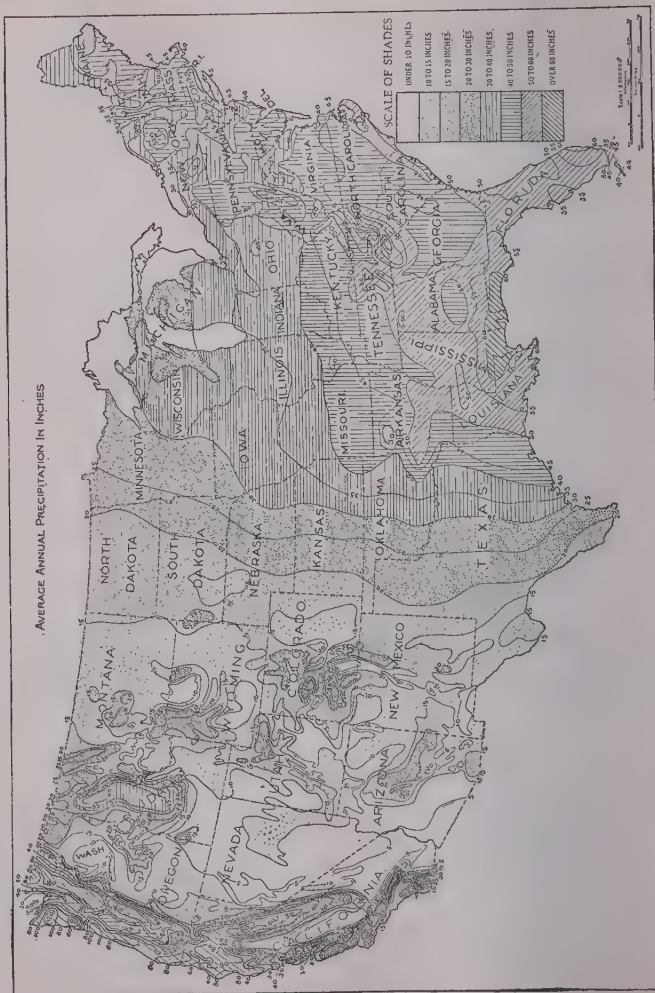
The fire worm is combatted by flooding the bog for a few hours four weeks after the winter water has been let out.

The girdler is checked by flooding after harvest. The fulgorid, a troublesome jumping insect, is controlled by spraying with nicotine sulphate, 1 pint to 100 gallons of water, to which has been added 5 lbs. of rosin fish oil soap. Sanding checks the tip worm which attacks the bud. Keeping the bogs free from weeds reduces insect and disease troubles.

Leading Varieties.—The leading varieties in Massachusetts are Early Black, Centerville, Chipman, Howes, Matthews, and McFarlin.

In New Jersey, Centennial, Early Black, Late Howes and Late Jersey are the leading varieties.

In Wisconsin, Bell and Cherry, Bell and Bugle and Searles Jumbo are leading varieties



Chapter XXXIX

THE STRAWBERRY

The strawberry is grown on every continent and practically all over America. The modern strawberry is strictly an American production. Large quantities of strawberries are grown commercially in New Jersey, Delaware and Maryland, Missouri, and other states. The earliest berries arriving in eastern markets are grown in Florida. In England they are grown quite largely as a greenhouse crop, but in this country that is hardly profitable on account of the very early arrivals in the North of Florida grown fruit.

Soil.—Strawberries are grown on all types of cultivated soil from light sand to heavy clays. For good results the soil should contain a liberal supply of humus. A light, warm soil will produce earlier crops than heavy soil.

In California, where irrigation is practiced, a light soil over a heavy subsoil is used, as too much water is required on light, deep soils. The water is controlled by ditches along the rows.

The strawberry thrives in good soil and delights in cool weather. Where the summers are hot and dry, the space between the rows may be mulched to advantage, where marsh hay, lawn clippings or similar material may be had. This keeps the soil moist and cool. The same result in large beds is accomplished in a measure by frequent shallow cultivation.

Strawberries ripen very early before the weather becomes warm, both South and North. In Canada the fruit ripens later and over a longer season.

Weeds and white grubs are the two most troublesome difficulties the strawberry grower has to contend with. Therefore the location should be one where there have been cultivated crops. Mulching helps keep down weeds where this system can be used. The land should be deeply plowed in the autumn and left in ridges to benefit by the action of the frost. In the spring it should be thoroughly worked and finely pulverized.

Planting.—The land is then marked out for planting. Various forms of markers are used for this purpose, marking from one to eight rows at a time. Small plantings can be set by a garden line. The rows are from 3 to 4 feet wide to permit of cultivation. Home gardens worked by hand may be somewhat closer. The plants are set from 18 to 24 inches apart in the row.

Matted Row System.—If the matted row system is used, runners from the plants first set are used to fill the spaces and make rows of plants nearly 2 feet wide. This system gives a good yield but the fruit is not of maximum size. The plants are plowed under after producing a crop or two.

The single row system consists of setting the plants about 2 feet apart in the row and the rows 3 feet apart. The runners are used to fill the spaces between the plants and confined to a single row of plants.

The Hill System.—In some localities, commercial growers use the hill system and this will give the best results for home gardens. It is quite generally used in Florida. The plants may be set at any desired distance apart, but only one plant is permitted to develop in each hill. All runners are removed as soon as they appear, except when plants are wanted for additional beds and these are removed as soon as roots have

formed. The beds are cultivated by hand and kept in good order for several years.

Strawberry plants when received from the grower should be unpacked as soon as received. Soak them in water and either plant immediately or set them in trenches in narrow rows. Shorten the roots by cutting off from a third to a half, according to their length. Remove dead leaves and runners.

In handling the plants in planting, keep the roots wet. Exposure to sun and wind may be fatal. Trenches may be made and the plants set in them, carefully spreading out the roots and firming the soil over them.

Care must be exercised in setting the plants at just the right depth. If set so deep that the crown is covered, the plants will rot. If not set deep enough the roots will dry out.

Planting Season.—Spring planting is the custom of commercial growers in the North. For home gardens pot grown plants set out in the autumn will give a crop of fruit the next summer.

In some parts of the South the planting is done in the autumn. In Florida from June to November. On the Pacific Coast in the autumn.

Pollenizing.—Catalogues describe strawberries as perfect and imperfect to guide the planter in selecting proper varieties to insure good crops of fruit. The perfect varieties bear staminate and pistillate flowers and pollenize themselves. The imperfect varieties bear only female or pistillate flowers and they require either a staminate or a perfect variety planted in the next row to pollenize them. Two rows of each variety may be planted or even two or three rows of imperfect varieties to one of a pollenizer. Planting only perfect varieties avoids all consideration of this matter.

Pollenization is quite largely accomplished by insects. If

the weather is cold when the plants are in flower or other conditions are unfavorable to insects, undeveloped fruits and a small crop will be produced.

Cultivation.—Begin shallow cultivating as soon as planting is finished and let it be sufficiently frequent to keep all weeds down and the top soil loose. When runners form, the cultivation is only up and down the rows, except in the hill system, where the work is done by hand and all runners removed as fast as they appear.

In the North, the plants will be benefited by a mulch of straw, hay or strawy manure, providing the latter does not carry weed seeds, applied late in the autumn as soon as the ground freezes. In very cold regions the mulch should be quite heavy.

One important object of mulching is to prevent freezing and thawing, which heaves the plants out of the ground, tearing the crowns from the roots, killing them. The mulch should remain in the spring to keep the ground from thawing too early, preventing the plants from flowering so early that the blossoms may be injured by late spring frosts.

When growth starts in the spring the mulch is removed from over the plants, but left under them and in the rows, to retain soil moisture, keeping down weeds and keeping the fruit clean.

Where the space between the rows is mulched, less frequent cultivating will be required, only sufficient being given to keep weeds down. The mulch is removed for cultivating and either kept for the next winter's use or put on the compost heap.

Good crops of large fruits are made only from plants producing many flowers having numerous pistils and the number of flowers and pistils depends largely on the care given the plants in the autumn.

Greenhouse culture for early fruit consists of potting in six inch pots the first runners formed. These are plunged in sand or ashes in a cold frame in October until late in December or early in January, when they are brought into the greenhouse and given liberal doses of liquid stable or cow manure, preferably the latter. The blossoms are pollenized by hand with a camel's hair brush, except where there are sufficient insects to make this unnecessary. From six to a dozen berries are permitted on each plant and these will be ready for the table in from ten to twelve weeks after the plants are brought in under glass.

For field crops, need of cultivation and mulching may be reduced by irrigation. This is necessary in California and is managed by ditches along the rows. In other regions the overhead sprinkler system is largely used with excellent results.

Harvesting.—The fruit is harvested when of good size and color and while it is firm. The berries are carefully picked with the stem and hull remaining on each berry and only when the fruit is not wet. It is cooled, packed and shipped as soon as possible. Grading may be done by the pickers.

The pickers use trays holding four quart baskets. Different baskets are used for different sized berries. In some localities the pickers pick all ripe fruit which is emptied into pans.

Each pan is examined, poor specimens removed and the fruit turned back into the boxes.

Packing and Shipping.—Pint or quart boxes are used and these are shipped in crates holding 24 or 32 quarts, the quantity marked on the crate.

The boxes should contain clean fruit and facing the top makes the boxes attractive. This can be quickly done by an experienced person, but the fruit in the box should be of uniform size.

The packing should be done in a shed, which may be only temporary, affording proper shade and working tables.

Car lots require floor racks to insure proper ventilation. The crates are loaded with a space between each crate and braced so there will be no shifting.

Less than car lots are shipped in refrigerator boxes. A system invented by Parker Earle of Illinois, the father of shipping fruit in refrigerators and refrigerator cars. The Parker Earle strawberry was named in his honor.

These small refrigerators hold from 64 to 80 quarts and are quite largely used in the South and in California. A metal lined compartment contains the ice. The boxes are returned to the owner.

Rotation.—Various systems of rotation are practiced in growing strawberries. In the North strawberries are grown two years and then are turned under and followed by some cultivated crops for two or three years, followed again by strawberries for another two years.

In the South, strawberries are grown for two years and then followed by cow peas, then a crop of oats, then corn, followed by strawberries.

In some of the Southern States, Florida, Texas, and the Gulf States, new beds are planted each year in September, fruiting from January to April.

Propagation is by means of runners which form freely and root quickly. They may be transplanted as soon as well rooted or may be allowed to remain where they are growing until the following spring. Division of the plants may also be used, particularly on any varieties that do not form runners freely.

New varieties are obtained from seeds. Producing seedlings is interesting but is not always profitable. The varieties cannot be depended on to come true to the parent from seeds and this method is used only to obtain new varieties.

Fertilizing.—Stable manure is the best fertilizer for strawberries. If manure is used as the fertilizing element, it is best to apply it to the crop preceding strawberries and then give that crop good cultivation to get rid of the weeds introduced with the manure. As high as 30 to 50 loads of manure are used to the acre, as the strawberry thrives on soil rich in organic matter.

When the land for strawberries is plowed, harrow, and then if additional fertilizer is desired spread half a ton of acid phosphate to the acre and harrow lightly again. Some growers use as high as 500 lbs. of dried blood to the acre, or 200 lbs. of muriate of potash, or a ton of wood ashes. Manure and acid phosphate give good results on many soils. Different soils require different fertilizers. Lime is not used for strawberries and wood ashes in some soils may give unfavorable results.

Everbearing or autumn bearing varieties are comparatively new and have not reached the limit of perfection. Improved autumn bearing varieties may be looked for. These bloom continuously until late autumn. To obtain a fair crop of good-sized berries, all the blossoms should be picked off as they appear until the middle of July.

Autumn fruiting varieties are suitable for late berries for home use and possibly for nearby markets and roadside stands, but they have not yet been established as a profitable market fruit.

LEADING VARIETIES OF STRAWBERRIES

In Small Fruits, Dr. U. P. Hedrick's monumental work, more than a thousand varieties of strawberries are described and this is not a complete list. Only a few varieties are of commercial importance in America.

Perfect varieties are indicated by the letter P after the name of the variety, imperfect by I.

Aroma. P. Medium late. The leading variety in Arkansas, Kansas, Southwestern Missouri and Kentucky; largely grown in Northern Central States. Berry of uniform large size; conical; firm; good shipper; good quality; attractive. Plants vigorous and healthy. Yields well.

Big Late. I. Late. Berries large, of good flavor and color. Ships well and yields well. Should be grown with varieties like Joe or Aroma.

Brandywine. P. Late. Fruit large; dark crimson; quality good; firm, ships well. Largely grown in California where it is free from leaf spot.

Bubach. I. Mid-season. Good for home use or nearby markets but should be grown with a perfect variety. Quality good. Does well on heavy soil.

Chesapeake. P. Mid-season. Fruit large, of bright color and good quality. Firm and ships well. Does well on a variety of soils. Makes few runners. Plants healthy and productive.

Clark. P. Mid-season. Berry of medium size, dark red and firm and of good quality. Largely grown in Hood River Valley, Oregon and other western sections; fails in the East. Not a heavy yielder. Good for canning.

Cooper. P. A new variety. Mid-season. Berries large to extra large, bright red and of good quality. Not sufficiently tested to warrant extensive planting. Has heavy roots and seems to do better than other varieties in dry seasons.

Corsican.—See New York.

Dr. Burrill. P. Mid-season. Large, dark red berry. Closely resembles Senator Dunlap.

Dunlap, Senator Dunlap. P. Mid-season. Berry medium to large, glossy dark crimson, medium firm. Runners freely. Good for home use and local markets.

Ford. P. Late. Berries large, dark red, firm and sweet.

Gandy. P. Late. Berry large and uniform in size, dark scarlet. Quality good. Needs strong soil and moisture. Ships well.

Glen Mary. I. Mid-season. Berries, large, crimson of good quality, but somewhat soft. Does best on heavy soil. Requires liberal fertilizing.

Haverland. I. Mid-season. Berries medium to large, bright scarlet, medium firm and of good quality. Very productive. Dunlap is a good pollenizer for this variety.

Howard.—See Premier.

Joe, Big Joe, Joe Johnson. P. Mid-season to late. Berries are very large and of good quality. Does well on a variety of soils. Good for local or nearby markets.

Klondike. P. Mid-season. Berry medium to large, dark crimson of fair quality. Runners freely. Largely grown in the South for northern markets and also in Southern California. Good for canning.

Late Stevens.—Late. Large, firm berries of fair quality. Grown in Delaware and New Jersey for market.

Lupton. P. Late. Large, deep red berries that are firm and ship well, but only of fair quality. Fairly productive on most any soil.

Marshall. P. Mid-season. Large, deep crimson berries of good quality. Good for home use or for forcing. Does best on a rich heavy soil, failing on sandy soil. Suitable only for home use or where high culture can be given.

McAlpin. P. Late. Vigorous grower that does well on poor, light soil, but thrives on richer soil. Berries medium to large, brilliant scarlet, of good quality, held well off the ground. Productive and ships well. Foliage subject to rust in wet seasons. Runners very freely. Plants should not be allowed to become crowded.

Missionary. P. Early to mid-season. Berry medium to large, dark crimson, of good quality. The fruit is firm generally, but soft in some sections. Popular throughout the South

and is the variety mostly grown in Florida, where growers often pick by Christmas, shipping to northern markets. Adapted to light sandy soils.

New York, Corsican, Ryckman, etc. P. Mid-season to late. Berries large to very large, crimson, of good quality. Mild and sweet. Very prolific. Forms runners freely. For home use or fancy nearby markets. This variety is known under many names, Roosevelt, Otto, Oswego and others.

Nich Omer. P. Mid-season to late. Berry is medium to large and of good quality and firm. Largely grown in the West. When grown in the East the fruit lacks quality.

Oregon. P. Early. Large, dark crimson, firm berry. Grown on the Pacific Coast.

Orem. P. Very late. Large, handsome berries of good quality. Not as good quality as Wm. Belt.

Parsons. P. Mid-season. Berry medium to large, crimson and of good quality. Requires plenty of manure and good cultivation. Runners freely. Good for canning. Subject to leaf spot.

Pocomoke. P. Mid-season. Berries large, glossy red of fair quality and firm. Good shipper. Plants hardy and productive. Largely grown in Michigan, Middle West and in New York. Gibson is practically the same as this variety.

Premier. P. Howard 17. Early. Berries are large, firm, uniform, glossy rich red all through the berry. Quality fine. Ships well. Plants are vigorous, productive and healthy and

do well most anywhere and on any soil, but do not seem to be suitable for Florida. Strawberry growers should try this variety.

Sample. I. Mid-season to late. Berries large, dark crimson, of good quality. Hardy. Runners freely. Grown in the North and West. Good for home use and local markets. Dunlop makes a good pollinator, or Joe or Aroma.

Sharpless. P. Mid-season to late. An old favorite, especially for home use. The berries are large but irregular in shape, bright scarlet, medium firm and of good flavor and quality. The plants are spreading. The berries are likely to have green tips, but the flavor is nevertheless good. Does best in hills and should have good soil and good cultivation. Largely grown on the Pacific Coast.

Superior. P. Early to mid-season. Berry medium sized; small after first picking. Grown in Delaware and New Jersey for canning.

Trebla.—Grown in California for canning. Heavy yielder. Fruit is harvested like raspberries, without the calyx.

Warfield. I. Early to mid-season. Berries are small or medium and only fairly firm, but handsome dark crimson and of fair quality and a good shipper. Runners freely. Yields abundantly. Cannot stand hot weather. Used where very hardy plants are required. Dunlop makes a good pollenizer.

William Belt. P. Medium late. Berry large, bright crimson, medium firm, quality excellent. Plants spreading with numerous runners. Good for home use and nearby market.

Plants rust in some sections. Does best in rich, moist soil. Does not do well in sand. Keep runners off for best results. Worth a trial in the home garden.

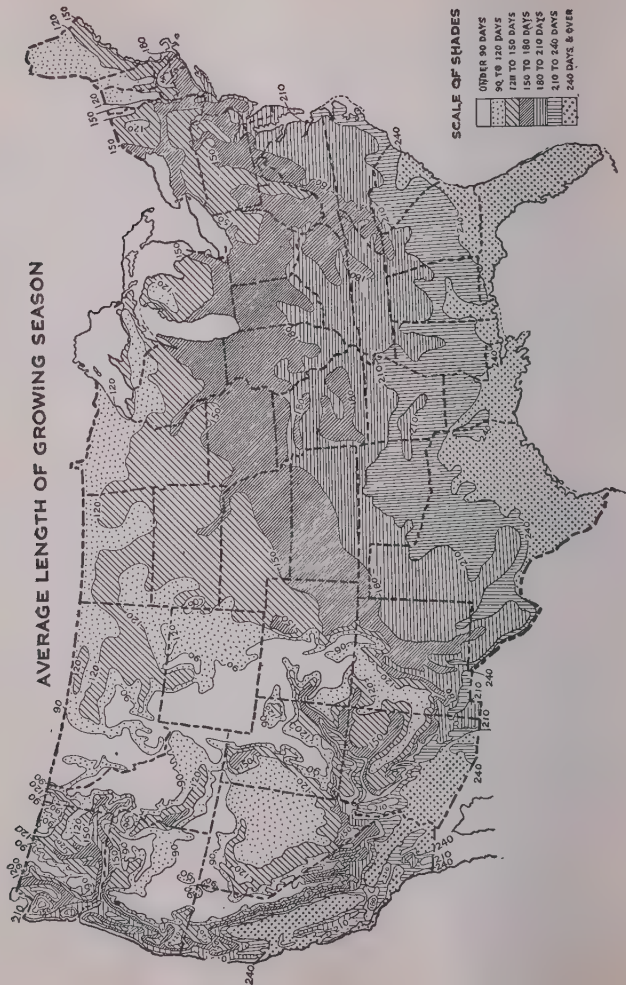
Wilson. P. Early to mid-season. Berry medium round, crimson. Flavor acid. Solid and ships well. When allowed to fully ripen on the plants the flavor is best. This variety was the first popular American variety and was generally grown for home use and market. It colors early and is marketed before it is ripe, but the fruit then is very sour. Largely grown in eastern Canada and on the Pacific Coast where it is used for canning. It is a good pollenizer for imperfect varieties. Does best in rich soil, well supplied with humus. Stable manure is the best fertilizer.

Everbearing Strawberries

Champion, World's Champion. P. Berries of medium size, crimson and of good flavor. Give rich soil, frequent shallow cultivation and keep off blossoms until July 1st. Keep up cultivation until hard frost. Very similar to Progressive.

Mastodon. P. Berries of good size, firm and of good quality.

Progressive. P. The best of this class for the South. Berries of medium size, firm and of good quality. Does best under the hill system or in a narrow row.



Chapter XL

THE PERSIMMON

The Persimmon, *Diospyros Virginiana*, is one of the ebony family. It originally grew wild from Connecticut to Illinois and South. Trees 20 to 60 feet high with spreading branches. The wood is dark colored and very hard. The fruit is sour and stringent, but yellow, sweet and eatable after a frost.

The blooms appear in May and June and are very fragrant. The tree is not particular as to soil, but likes ample sunshine.

Propagation.—There are several named varieties. These are propagated by budding or grafting, which may be done whenever the bark will open easily. The wound must be tightly closed and the air excluded. Some trees bear male blossoms only. The native persimmon has a heavy tap root and is, like other tap root trees, rather difficult to transplant.

The trees are planted twenty feet apart each way and headed low.

The fruit is packed in single layers, in light wooden boxes, so they will carry safely and not move or bruise in transit. It is harvested carefully when hard ripe, just before beginning to soften. Persimmons have a high food value.

The Japanese and Chinese persimmons, *diospyros kaki*, is native of China. It is grown in Southern New Jersey, but chiefly south of Washington, D. C. Most varieties will not stand zero weather. There are low growing, dwarf varieties and tall growing kinds 40 feet high.

The flowers appear on wood of the current year. Some trees bear male or staminate flowers and others bear pistillate or female flowers. Another season they may produce perfect flowers. Other trees bear all three. The dark fleshed varieties are not astringent and may be eaten before they are soft ripe.

The kaki, or Japanese and Chinese persimmon, will grow where the fig can be grown. The soil should be deep, well supplied with humus and well drained.

Propagation.—The trees are propagated by budding on native seedling stock. In the West, Japanese stocks are used. The seeds for stock are sown in nursery beds and transplanted the following spring into field rows. The stocks are budded or grafted and as soon as the cion or bud has made a good growth, the trees are transplanted.

Planting.—The trees are set 20 to 24 feet apart and the usual caution to protect the roots from wind and sun must be exercised, keeping them moist until set, cutting the tops back to 2 feet and the tap root back to 18 inches. The same cultivation should be given as for oranges.

*Chapter XLI*CITRUS FRUITS
ORANGE AND
GRAPEFRUIT

The orange is the most important citrus fruit from the point of commercial value of the crop. California and Florida lead in production. Southern Mississippi and Alabama are producing somewhat; Texas is developing the industry, and Arizona to a limited extent.

In Mississippi and Alabama the Satsuma orange, budded on sour orange are used.

Oranges, as may be judged from the nature of the fruit, require an ample supply of water to properly develop a crop, and this must be supplied either by rainfall or irrigation. Frost is fatal to oranges. Freezing will destroy the trees.

As in other fruit growing, the location must be right as to climate, soil and water and convenient for getting the fruit to market. Marketing organizations have been developed in California and Florida that have been of great value to producers.

The orange is a tropical plant, though it may stand a temperature somewhat below freezing; 24 degrees F. causes severe damage. The Satsuma has survived 18 degrees.

Owing to damage by frost, the trees in Florida are given winter protection, by mounding earth up about them, as high

as possible. If the tops are killed, the trunks remain on which new tops are worked.

When the trees are dormant they will withstand considerable cold. As the winter is colder in California than in Florida, the trees are dormant and less likely to injury than in Florida where the weather is warm and the trees are in growth and easily affected by sudden frosts.

Oranges are long lived trees, not reaching full bearing age until quite old. In California not until about thirty-five years old are the trees considered in full bearing. When ten years old about half a crop is produced.

Soil.—Oranges are grown on various soils in Florida, elevated land on which live oaks and magnolias grow, called high hammock, also on low hammock and land on which yellow pine flourishes.

In California, deep rich loam is considered best. Where there is hardpan it is broken up by dynamite. Shallow soil is unsuitable. The orange is a gross feeder and must have plenty of humus in the soil and be liberally fertilized. Where rainfall is ample, good drainage is important. Where there is water three or four feet below the surface is a good location, other conditions being favorable.

High winds are unfavorable, damaging the fruit as it is knocked against the branches, or it may drop. Unusually high temperature may cause the fruit to drop.

Planting Time.—Local conditions govern the time of planting, which should be done at the beginning of the rainy season of summer. Before the dry season is unsuitable. In Florida, planting is usually done in the winter, but sometimes just before the summer rains. March is the planting season in Southern California.

Planting Distance.—In Florida, the trees are set 25 by 25 feet and 20 by 30 feet, according to the ideas of the planter. Satsumas are set 20 by 20 feet.

Setting the Trees.—The trees are set in straight rows. Burlapped roots may be planted with the burlap on, removing only the bottom, puncturing the ball in several places, so water can be admitted. The solid ball otherwise may shed the water needed by the roots. The tree is set only as deep as it was before, as deep planting is injurious. The burlap soon rots.

In California balling is quite common, as the trees are less perishable and do not require all the top removed. The cost is considerable and the weight makes the freight rate high.

In digging the trees in the nursery, a trench a foot wide and fifteen inches deep is dug alongside of a row of trees and the tap root carefully cut and the tree lifted with a ball of earth. This is wrapped in sacking and firmly tied with cord. The top is cut back, the leaves removed and the trees shipped.

Orange trees are shipped safely from California to foreign countries with the bare roots firmly packed in sphagnum moss.

The land should be plowed and harrowed and put in good condition before planting. In California where irrigation is practiced, land is selected, if possible, with a slight grade, and ridged with a plow where the trees are to be planted. When the trees are set, the hole is filled a little more than half full of earth and water from the irrigation ditch collects. This is allowed to settle when the balance of the hole is filled.

Freshly cleared land in Florida is likely to be acid. Here the holes are dug two to three months before planting and lime scattered over the hole and the pile of soil, to neutralize the acid.

Mulching.—Florida planters mulch the soil around newly planted trees with straw, leaves or other material to keep the soil moist and supply humus. This is good practice generally in tree planting. Stable manure is not considered suitable for mulching orange trees.

Cultivation.—On moist soils in the South no tillage is given, but the growth is cut down frequently during the summer. Some groves are plowed in the autumn, the furrows turned toward the trees. In the spring the land is cultivated every two weeks until the rainy season. Some cultivate in the winter to keep down the cover crop or weeds, in place of plowing. Cover crops and weeds are permitted to grow when the rainy season sets in. Velvet beans, cow peas or other leguminous crops are used. These are cut and left to decay.

In California the soil varies considerably and cultivation varies accordingly.

Some soils are deep loams with plant food in abundance and retentive of water. Other soils are too well drained, being underlaid with gravel or not sufficiently well drained having an unbroken hardpan.

The usual plan is to plant in the spring, turning under a green crop, or the crop may be disked in. In spring and summer frequent cultivation is given and after irrigating to maintain a loose surface soil or dust mulch.

Cover Crops.—Green crops are grown or a mulch supplied to keep up the humus content of the soil. The humus content must be maintained and fertilizers used on bearing trees.

Where cover crops can be grown, this is advisable. If water is insufficient for this purpose, heavy mulching should be resorted to to keep up the supply of humus and needed nitrogen.

Straw, hay, bean or pea straw, stable manure, or similar material should be used. For cover crops sweet clover, vetch, cow peas, buckwheat and alfalfa are used. Alfalfa, where it can be grown, is an excellent cover crop. The deeply penetrating roots loosen up the soil to a great depth.

Fertilizers.—Fertilizing needs depend on the character of the soil and only testing, trying and watching results will show what will be most beneficial. Too much nitrogen causes excessive plant growth, inducing the fruit to ripen late and to have very thick skin. Want of potash may cause thick skins. In California, on rich land, young trees require little or no fertilizer. From seven to twenty years, mixed fertilizer is used in increasing quantities. At about six years old, four pounds per tree are used, increasing at the rate of a pound a year until twenty pounds per tree is reached. The fertilizer is applied in several applications by some, and all at one time, in the spring, by others.

Nitrate of soda must be used cautiously; on heavy soils it may form black alkali and this will seriously injure the trees. Urea is a better fertilizer for citrus fruits.

In rich soil in Florida, fertilizers are not used until the third year when the trees begin to fruit. Increasing amounts are used annually, until about the sixth year, up to 1,500 lbs. per acre are used of a mixed fertilizer consisting of sulphate of ammonia, bone black and sulphate of potash. This is applied in November to February, another application being given in May to July. The amount of fertilizer used depends on the character of the soil. What would be too much on some land would be too little on other land.

The soil in Louisiana is much richer than some land in Florida. Here a mixed fertilizer is used, having fifty pounds of nitrogen, fifty pounds of potash, and twenty-five pounds of phosphoric acid per acre, applied in the early spring.

Lime is used freely on some Florida and California soils, in the form of ground limestone, up to two tons per acre. Lime has an injurious effect on oranges or other citrus fruits in some cases, causing a yellowing of the foliage, probably because the soil already carries sufficient lime.

Inter Cropping.—Vegetables are sometimes grown between the trees in young groves. Alfalfa is grown by some for the first five years between the trees, and the crop used for mulching the grove. Crops that require much moisture, such as strawberries, are inadvisable, because they take up the moisture the trees require.

Irrigation.—Deep furrow irrigation is the system most generally used, the furrows close enough to supply all the roots. On light soils the furrows are not more than 300 feet long.

Basin irrigation is used on light soils. A furrow is thrown up around the tree and the water run on the surface of the basin in a heavy stream. On heavy soil the basin is flooded for three or four days, to permit the water to soak well into the soil.

The pipe and stand is also used, the water run in underground pipes, escaping from a standpipe under each tree. The overhead system is used where there are only a few trees.

The trees are irrigated every twenty or thirty days. Over irrigation is injurious, especially to young trees; it may cause alkali, malnutrition, scaly bark, etc. Young trees should have only just enough water to supply soil deficiency. Too much

water causes surface roots, instead of deep rooted trees that are able to go deep for food and moisture.

Use a soil sampler to determine the moisture down to a depth of six feet.

Propagation.—Citrus trees may be propagated by budding, grafting, layering, cuttings and by planting seeds. Budding is the common method. The stock most used is the common sweet or sour orange of Florida or rough lemon.

The seeds used for stock should be from strong growing, healthy trees and all poorly developed seeds discarded when taken from the fruit. Twice to four times as many seeds are planted as stock needed, and only the most vigorous seedlings are used.

The seeds are removed by cutting the fruit in half and squeezing the seed into a sieve. On a large scale, the fruit is placed in barrels and allowed to rot, the seed is then washed from the pulp with running water and a sieve. The good seeds are heavy and will sink. The poor, light seeds will float and run off with the water in washing.

The seeds should be planted immediately or stratified in sand. If the seeds are to be kept for any length of time, they should be dried off, then mixed with equal bulk of pulverized charcoal and stored in tight tin cans. Even in this way the seeds will only keep a few months.

If a large number of seedlings are to be grown, a well prepared seed bed should be provided, located a distance from old trees. Unless the soil is naturally rich, fertilize the bed two or three weeks before planting the seed. Late in September or October, the seed is planted thickly, about an inch deep. Have the soil damp. Pomelo seedlings make good stock for moist soils, but are not good for porous soils.

Along the Gulf Coast the Japanese orange, Trifoliate orange

is used. It is a hard, thorny, hardy tree and makes the cions more hardy and earlier ripening.

Cultivate frequently and keep free from weeds. The seedlings must not be allowed to dry out.

Damping off of young seedlings must be watched. Give shallow cultivation if this appears, to dry the surface, then spray with Bordeaux.

Some growers have the seed bed under a slat shed, for shade, the slats placed on posts high enough to allow head room. Shaded seed beds should only be used once.

The seedlings remain in the seed beds until they have had one or two seasons' growth. When about a quarter of an inch in diameter at the surface of the ground, they may be planted in nursery rows, but it is better to wait until the plants are of good size before transplanting.

The seed bed, if thoroughly watered before taking up the seedlings, will fill the plants with water and they will transplant better.

In digging the seedlings, push the spade down beside them about ten inches to cut the tap root and loosen the plants.

The plants are bundled in bunches, the roots and tops trimmed back on a block, with a sharp hatchet, dipped in a disinfecting solution. The plants are then packed in boxes of wet moss and set out in nursery rows. Cutting off the tap roots develops a well branched root system. Great care must be used in keeping the roots of citrus trees wet when transplanting, protecting them from wind and sun.

In Florida the transplanting of the seedlings is in November and December or in summer when rains occur.

The land in the nursery is cultivated thoroughly and liberally fertilized before the seedlings are set out. A second application of fertilizer is given in June and another in August, using from 300 to 500 lbs. to the acre. The rows are set perfectly

straight, $3\frac{1}{2}$ to 4 feet apart. The plants are set from 1 foot to 15 inches apart in the rows. If the soil is dry, apply water. Give thorough and clean cultivation, but this should stop in time to let the wood harden for cold weather.

In a year or two after transplanting, the seedlings will be half an inch in diameter at the surface of the earth and will be ready for budding.

The scab fungus attacks sour orange seedlings, in some sections and these should be sprayed with Bordeaux.

Budding.—Budding may be done any time in the growing season. In Florida budding done in September and October is called dormant budding. The buds remain dormant until spring. In cold sections the dormant buds are protected by plowing a furrow against them. The furrow is removed in March and the buds start into growth.

The point of union between stock and cion is more sensitive to cold than any other part of the trunk. Damage from cold is easily prevented if the bud is set low on the stock. On some soils, if the bud is set too low, there is danger of having sweet, mandarin or lemon trunks attacked by foot rot and to escape this danger, the bud should be inserted well above the ground. Where irrigation is used on lemons, the union should be high enough to protect the lemon trunk from moisture. Where trees are troubled with gum disease, generally near the surface of the earth, it is advisable to insert the buds well above the ground.

In California shield or T-budding is the custom. In Florida the inverted T cut in the stock is used. A strip of cloth waxed with grafting wax is wrapped about the stock over the bud, to hold it firmly in place.

Two weeks after the buds have been inserted, if they are still green and new tissue is seen around the edges, the union

has been successful. When the buds are well united, remove the bandages and prune back the stock. Any buds that have failed should be rebudded.

Each bud should have a stake about 1 inch square and 4 feet long placed beside it and tied to the stake with raffia or cotton cloth. The growth from the bud is tied up as it develops to keep it straight. All sprouts are kept off the stock.

When the growth from the bud is sufficiently high, it is cut off so side branches will form. Low headed trees are generally used now, forming the heads at about two feet high.

Frequent cultivation is given to retain moisture and keep down weeds. Stop cultivation in time to permit growth to cease so the trees will not be injured by winter frost.

Top Working.—Undesirable trees may be top worked by budding or grafting.

Pruning.—Citrus trees require little pruning, except at time of planting. In the early days of citrus fruit culture, as in the early days of apple growing, the trees were headed high. Now both fruits are grown with low headed trees and for much the same reason.

With citrus trees the object is to have the branches low, but not so low that the fruit will rest on the ground and where possible without supports. The foliage of the low limbs protects the trunk from cold and also from the hot sun. Spraying and picking the fruit is easier on low headed trees.

When the trees are planted, they are cut back to about two feet in height. The branches which are to form the frame work are permitted to develop four or five buds near the top.

All buds that develop below the union should be promptly removed by rubbing off or cutting off, but the buds that develop above the union may be allowed to remain and develop

for a season or two as they assist in developing the tree. After the second year thin these branches out, leaving only those that are to form a well balanced head. Pruning on old trees consists chiefly of cutting out dead wood and removing such limbs as necessary to prevent their rubbing together.

Frozen trees should not be pruned immediately, but should be left until the trees show to what extent they have been damaged. This will be seen as soon as growth starts. The more severe the damage by freezing, the later the trees will be in starting again. Give the branches that start in growth, enough time, so it may be determined that they will not die back. Then the pruning may be done.

Trees badly frozen so the trunk is killed are cut off at the ground. The stub is used to insert grafts into or sprouts are developed and budded when large enough. The sprouts may need supporting by wire drawn around them.

In cutting back wood that has been killed, cut below the top sprouts, after they are well developed. Cut too far back rather than too little.

If the bark has been killed by freezing, the damaged spot should be cut away, back to healthy tissue, immediately treating the cut surface with an antiseptic, such as bichloride of mercury (poison), 1 part to 1,000 parts of water and the wound painted as soon as the antiseptic is dry.

If there are any gum diseases, the spots should be thoroughly cleaned, cut back to healthy tissue, and the wound disinfected with a solution composed of protexol, 1 gal.; soap, 1 lb.; water, 1 gallon. Dissolve the soap in water and add the protexol. As soon as dry paint the wound.

Pruning may be needed on old trees that are failing in bearing. The trees are cut back heavily and new tops produced. The trees are then whitewashed as a protection from sunburn.

High headed trees are sometimes cut back to produce lower

heads. Branches start from below and those are allowed to remain. Some are drawn down below the lowest branches where they develop to bring the head down lower.

Citrus tree heads should be so formed that the foliage of the top will entirely protect the limbs and trunk from the sun. Pruning, if severe, is often followed by die-back. Die-back often occurs after freezing.

Root pruning is so far the remedy for die-back. The roots are cut with a sharp spade in a circle about the tree. The spade is driven well down so as to cut many roots. The extent of the pruning depends on the size of the tree, the nature of the soil and the severity of the attack. The cause of the trouble should be studied and removed.

Dead wood and wood affected with fungus should be cut out. As soon as a branch has been removed it should be disinfected; then paint the edge, all around, where wood and bark meet, with shellac. This will dry quickly and then the whole surface should have a coat of white-lead paint. If the wood is left exposed, decay will soon start. Watch the wounds and keep them covered with paint until they have entirely healed over.

Orchard Heaters.—There are many kinds of orchard heaters, oil, coal and coke burners. A double row of heaters is placed on the side of the orchard to protect from the prevailing wind. The heaters are not placed under the trees, but near them, in rows so as to be conveniently reached by a supply wagon. A low grade oil is used. From fifty to two hundred heaters are used to the acre, according to the weather and the style of heater used.

With a one or two mile breeze, an increase of five degrees in the orchard temperature may be obtained by the use of about twelve gallons of oil per hour, per acre, with fifty standard

heaters. With large heaters burning one hundred gallons per hour per acre, the temperature has been raised from eight to twelve degrees.

Thermometers are hung four or five feet above ground and scattered about, using one or more to the acre. A flashlight is used for reading, so as not to raise the temperature by heat. An alarm thermometer is made, connected with distant buildings by wire, where it rings an electric alarm bell, when the temperature reaches a point at which the alarm is set.

Frozen Fruit.—In frozen fruit Hesperidin crystals, small whitish specks appear, due to chemical changes. They appear in oranges, lemons, mandarin oranges, kumquats and pomelos. The fruit may not be sufficiently injured to show from the outside. If frost is suspected, the fruit should not be shipped until it is known positively that it has not been injured. Severe frosts cause the fruit to drop.

Frozen fruit may be used in the manufacture of oil and citric acid.

Harvesting.—Oranges arrive in northern markets very differently today compared with the oranges as they were packed, shipped and retailed years ago.

The fruit is picked very carefully, clipped from the tree with clippers and handled very gently and kept clean. The lower fruit is usually first removed as it is the most likely to be injured by disease or frost.

Canvas bags which open and empty at the bottom are used by the pickers. These are emptied into lug boxes which are carried to the packing house in spring wagons. Here the fruit is weighed and stored for a few days.

Orange fruit growers' associations, the first successful organizations of the kind, have pickers who harvest the fruit skillfully and quickly, though some growers harvest and market their own.

Harvesting begins as soon as the fruit is ripe. In Florida, the early varieties are ready in October, and later these are followed by medium and late varieties. Oranges may be left on the trees for several weeks after they are ripe.

In California, in the northern section, harvesting begins along in November and lasts about two months. In Southern California, navel oranges are harvested from January to May. The Valencia are later than the navels, the harvesting of these ending in November. The Louisiana crop matures ahead of the Florida crop. Early varieties are grown.

Curing.—Oranges are cured before shipping. When first picked the skins are full of moisture and do not ship well in this condition. When cured, the skin or rind gets tougher and the fruit can then be handled and shipped more safely. Curing is effected in about five days. All that is needed to cure oranges is free circulation of dry and cool air. They may be cured in the lug boxes.

Grading and Packing.—This operation usually is done in a public or association packing house and much of the work is done by machines. The fruit may be brushed or washed. The water is kept at a temperature of 110° F. and washing powder is used to add to its effectiveness. Attached to the washing machine is a grader, that dries the oranges and as-sorts them into grades.

Packing.—The better grades of fruit are wrapped in tissue paper by women, and packed in boxes. The boxes are firmly

packed, so that as the fruit compresses and settles the cover will also settle down and hold the contents of the box firmly. The box is marked on the end with the number of fruit it contains.

The California box is 12x12x26 inches, outside. The Florida box is 12x12x12 inside. Satsuma and King oranges and tangerines are packed in boxes, half as deep.

Car Loading.—In loading the car, the boxes are stood upon end, with an inch or two of space between for ventilation. Narrow strips of wood the width of the car are nailed to the ends of the boxes, two strips over each row, which hold the boxes firmly in place. A second tier of boxes is placed on the first. The car is filled from the ends; space between the doors is left until last. The boxes should be so placed that they cannot move in transit.

A standard car load is 384 boxes.

Yield.—The average yield in California is 158 boxes per acre. In Florida the average is about 150 boxes per acre. Much higher yields have been had in either state. A well managed grove should produce from 200 to 250 boxes to the acre.

Citrus Fruits as Pot Plants

All citrus fruits may be grown in pots or tubs. They are desirable for greenhouse or conservatory. Some succeed with them in a living room, especially the Otaheit orange.

The plants can be started from cuttings or seeds and budded when large enough.

Nurserymen in Florida and California will supply buds. The plants will thrive in good potting soil, such as florists use. Good garden soil two parts, sand one part with a little sheep

manure added makes a satisfactory soil. The plants should be moved into larger pots as they become pot-bound. Give good drainage.

The soil must not be allowed to dry out. Too little water will cause leaves and fruit to drop. Too much water will cause the leaves to turn yellow and fall. During the resting period of about two months in winter, less water will be needed and the temperature may be dropped to 50° F. After the resting period, give a temperature of 75° with plenty of light and air.

LEADING VARIETIES OF ORANGE

The Bigarade oranges, *citrus aurantium*, include the Bitter Sweet with fruit medium to large, with dark orange flesh; juice sweet and abundant; inner rind and partitions bitter. Season January to March. And the sour orange, similar to above but juice is sour. These varieties are used chiefly as stock for budding other varieties. They grow wild over Florida.

Spanish Oranges, Florida Varieties

Acme —Medium to large. Rind smooth and thin. Juicy, of good flavor. About 14 seeds. Florida season December and January.

Boone —Medium size; round; juicy and of good flavor. Seeds 25. Florida season October and November. Should be shipped as soon as colored. Likely to drop.

Dummit.—Large, oblate. Flavor and quality good. 14 seeds. December to February.

Early Oblong (St. Michael's Egg).—Round oblong. Flavor sweet; juicy; quality good. Seeds 22. September and October.

Enterprise.—Roundish oblong. Flavor rich; quality good. Seeds 6. Rind $\frac{1}{8}$ in. thick. October and November.

Foster.—Rounded, oblate. Medium to large. Quality good. Seeds 13. October and November.

Homosassa.—Round, slightly flat. Medium to large. Rind tough, smooth. Quality excellent. Seeds 20-24. December to February.

Indian River.—Rounded, medium to large. Rind smooth. Juicy and rich. Quality excellent. Seeds 17-20. December to February.

Madam Vinous.—Round-oblate. Small to large. Rind smooth. Juicy and of fine flavor. December and January.

Magnum Bonum.—Oblate. Large, orange yellow. Rind pitted and leathery. Flavor sweet and rich. Quality excellent. Seeds 13. December to middle of February.

May (Dr. May's Best).—Round. Medium to large. Rind smooth, thick, tough. Juice abundant. Flavor good. Seeds 6 or more. December and January.

Nonpareil.—Round-oblate. Medium to large. Rind thick; pitted. Flavor excellent. Quality excellent. Seeds 11-15. December and January.

Old Vini.—Round, with flattened top and bottom (oblate). Medium to large. Rind smooth, thick and tough. Very juicy. Flavor fine; quality excellent. Seeds 16. December to February.

Osceola.—Round. Large. Rind smooth, thick. Juicy and of excellent quality. Seeds 6-10. December and January.

Parson Brown.—Round-oblong. Medium to large. Should be picked early or it loses in quality. Rind smooth, $\frac{1}{8}$ to $\frac{3}{16}$ in. thick. October and November.

Stark (Stark's Favorite).—Round. Small to medium. Rind smooth, thin. Juice plentiful. Flavor rich and good. Quality good. Seeds 18. December to February.

Mediterranean Oranges

Tree standard or slightly dwarf. Some hardly distinguishable from blood oranges; foliage abundant, closely set. Fruit heavy, rich and of good quality. They are called Mediterranean oranges because, directly or indirectly, they are derived from Europe.

Bessie.—Round. Small to medium. Rind smooth, thin, tough. Juicy. Flavor excellent. Quality good. Seeds 14. March and April.

Centennial.—Round. Small to medium. Rind smooth, thin. Juicy. Flavor rich; quality excellent. Seeds 10. November—December.

Circassian.—Round-oblate. Medium to large. Rind thin and smooth. Juice abundant. Flavor good. Seeds 10-21. December to February.

Du Roi.—Oblong. Medium to large. Juicy. Flavor rich. Quality excellent. Seeds 14. February and March.

Everbearing.—Oblong. Small to medium. Rind pitted, thin. Juicy, Flavor good; quality good. Seeds 10. October to June.

Exquisite.—Round. Small to medium. Juice abundant. Flavor good. Seeds 28. December to February.

Hamlin.—Oblate. Size medium. Rind smooth. Juicy. Flavor excellent. Seeds 1-5 or seedless. October and November and later.

Jaffa.—Round-oblate, or round oblong. Medium to large. Rind smooth and leathery. Juice abundant. Flavor rich. Quality excellent. Seeds 9. December to February in Florida, March to May in California. Tree resistant to cold and almost thornless.

Joppa.—Oblong. Medium size. Rind rough. Juicy. Flavor good. Quality fair. Seeds few. January to March in Florida, March to July in California. Tree large and thornless.

Lue Gim Gong.—Oblong. Medium size. Skin thin, smooth. Juice abundant. Flavor good. Quality the best. Seeds 4 to 8. June to September. Keeps and ships well. Tree is resistant to cold. Fruit holds well on tree.

Majorica.—Round. Small to medium. Rind thin, smooth, tough. Juicy. Flavor rich. Quality good. Seeds few. February and March in Florida.

Maltese Oval.—Round oblong. Medium to large. Rind smooth, $\frac{1}{8}$ to $\frac{1}{4}$ in. thick. Juicy. Flavor sweet. Quality excellent. Seeds 6-13. Florida season March and April.

Marquis.—Round. Size medium. Rind thin and smooth. Juice abundant. Flavor sweet and rich. Quality good. Seeds 4. Florida season December to February.

Mediterranean Sweet.—Round. Small to medium. Rind thin. Flavor sweet and good. Tree semi-dwarf and almost thornless. California season April to June.

Paper Rind.—Oblong. Medium to large. Rind pitted. Juice plentiful. Flavor rich. Quality excellent. Seeds 6. Tree medium thorny; very productive; semi-dwarf. Florida season February and March. California, March to May.

Pineapple.—Varies in form. Medium to large. Very juicy. Rind smooth. Flavor excellent. Seeds 13-23. Florida's most important mid-season sweet orange.

Prata (Silver) Round. Medium to large. Rind smooth and tough. Juicy. Flavor rich. Quality good. Seeds 30. Florida season December to February.

Star Calyx.—Round. Medium to large. Rind smooth. Flavor and quality excellent. Seeds 18. Florida season December to February.

Valencia (Hart's Late, Hart's Tardiff, Excelsior).—Round or oval. Medium to large. Rind thin, smooth and tough. Juice abundant. Flavor rich. Quality excellent. Fruit solid and heavy. Good shipper. Seeds 6. Florida season March to June and also in Northern and Central California. Southern California June to December. Tree vigorous, with few thorns, prolific. Fruit hangs well, but in interior valleys of California

turns green if left too long on the tree. It is the most important late variety in Florida and California.

White.—Round. Medium to large. Rind smooth, thin. Juicy. Flavor rich. Quality excellent. Seeds 20-27. Florida season December to February.

Blood Oranges

Maltese.—Round-oblong. Size medium. Rind smooth, medium thick. Very juicy and sweet. Good shipper. Quality good. Seeds 4-8. Florida season December to April. Not very prolific

Ruby.—Round or oblong. Small to large. Rind smooth and thin. Very juicy, blood-red when fully ripe. Flavor rich. Quality excellent. Seeds 11. Florida season February to March, California March to April. Tree compact, almost thornless. This variety has no superior

Sanford Blood.—Round oblate. Medium size. Rind smooth glossy, thin and leathery. Orange in color at first, becoming streaked and finally blood colored. Juicy and rich. Seeds 14. Florida season January to March.

Saul Blood.—Form oblate. Small to medium. Rind thin, smooth and tough. Flesh yellow at first becoming blood-marked later. Flavor rich. Quality good. Seeds 16. Florida season December to February.

St. Michael.—Round-oblong. Size medium. Rind thin. Orange red throughout when fully ripe. Juicy. Flavor and quality excellent. Seeds present. Florida season January and February.

Navel Oranges.

The Washington Navel is the leading variety, grown in California. In Florida, navel oranges have not been a success, owing to the small crops which they usually produce there.

Bahia (Washington Navel, Riverside Navel).—Round. Size large. Rind smooth and tough. Juicy. Flavor rich. Quality excellent. Seedless. Good shipper. California season, January to May in the South; North and Central, middle of November to middle of January. Tree semi-dwarf. Bears at early age. Vigorous and nearly thornless. Heaviest yields are obtained near the coast.

Double (Imperial).—Holds the fruit better than most navels in Florida. Inferior to Bahia in California.

Egyptian.—Round-oblong. Large. Rind rough. Quality good. Seedless.

Melitensis.—Oval. Size large. Rind thin and smooth. Juicy. Quality fair. Seedless. Not prolific in Florida.

Surprise.—Round. Size medium. Skin smooth and tough. Juicy, rich in flavor and of excellent quality. Seedless. Florida season November to February. Seems to be the most suitable navel for Florida.

Sustain.—Round. Size medium. Rind thin and smooth. Juicy and of good flavor. Seeds 3-4. Florida season December and January.

Mandarin and Satsuma Oranges

This group is quite distinct from the sweet oranges, *citrus sinensis* or the sour orange, *citrus aurantium*. The leaves are small and pointed and the skin separates easily from the pulp.

The mandarin oranges are held in highest esteem in China, where they originated. As grown commercially in Florida they are practically all one variety, the Dancy, commonly called tangerine.

The Satsuma has not been grown commercially in California up to this time. This is the hardiest known, large fruited, edible citrus. The Satsuma has extended the cultivation of citrus fruits to a considerable distance north. The tree is hardy, maturing its fruit early, ready for shipment in October and November.

It has been reported that this variety has been grown in the open ground as far north as Washington, D. C., but the author has not been able to confirm the report.

Beauty.—Oblate. Rind smooth and thin. Juice abundant. Flavor rich. Quality excellent. Few seeds. December and January. Tree thornless.

Dancy (Tangerine, Bijou, etc.).—Form oblate. Size medium. Color deep orange red, shiny. Rind smooth, leathery, separates easily. Juice abundant. Quality and flavor fine. Seeds 5-10 or more. December and January. Tree upright and somewhat thorny.

Satsuma (Unshiu, Oonshiu).—Form oblate. Size medium. Color orange yellow. Rind thin, somewhat rough. Juice abundant. Quality and flavor excellent. Generally seedless. Season October and November. Tree is dwarf and thornless.

The smaller fruits ripen first, larger ones later. At their best just at maturity. Do not color well in Southern Florida. The Satsumas should be considered as a special group, rather than as a single variety.

China (Celestial, Mandarin, Kid Glove, etc.).—Form oblate. Medium size. Rind smooth. Juice plentiful. Flavor distinct and good. Seeds 15 or more. November and December. Tree willowy and thornless.

Cleopatra.—Form oblate. Size small. Dark orange red. Rind rough and thin. Juice plentiful. Flavor and quality good. Seeds 20. January and February. Tree willowy; thornless. Useful as an ornamental.

King (King of Siam).—Form oblate. Size large. Color deep orange. Rind rough. Juicy. Flavor and quality good. Seeds 18-20. March and April. Tree upright and thorny. Wood brittle. March and April. Tree bears heavily and may cause breaking of branches unless braced or the fruit thinned. Exposed fruit likely to sunburn.

Kinneloa.—Round-oblate. Size medium. Color red orange. Rind thin. Juice abundant. Quality and flavor good. Seeds 10.

Kino Kuni.—Form oblate. Small to medium. Rind rough. Juice abundant. Flavor sprightly. Quality good. Seeds 13-14. Tree compact.

Mikado.—Form oblate. Size medium to large. Color orange yellow. Rind slightly rough. Juice abundant. Flavor rich. Quality good. October and November. Tree not so reclining as Satsuma, of which it is a seedling.

Oneco.—Form oblate. Medium to large. Color deep orange yellow. Rind smooth, inclining to rough. Juice abundant. Flavor rich. Quality excellent. One of the very best. Seeds 12-14. January to March. Tree upright and thorny, with thornless branches.

POMELOS (GRAPEFRUIT) SHADDOCKS AND TANGELOS

Pomelo, plural pomelos, is the name now generally recognized for the grapefruit, *citrus paradisi*. It is called grapefruit because it is frequently borne in grape-like clusters. The trees are more easily injured by frost than oranges.

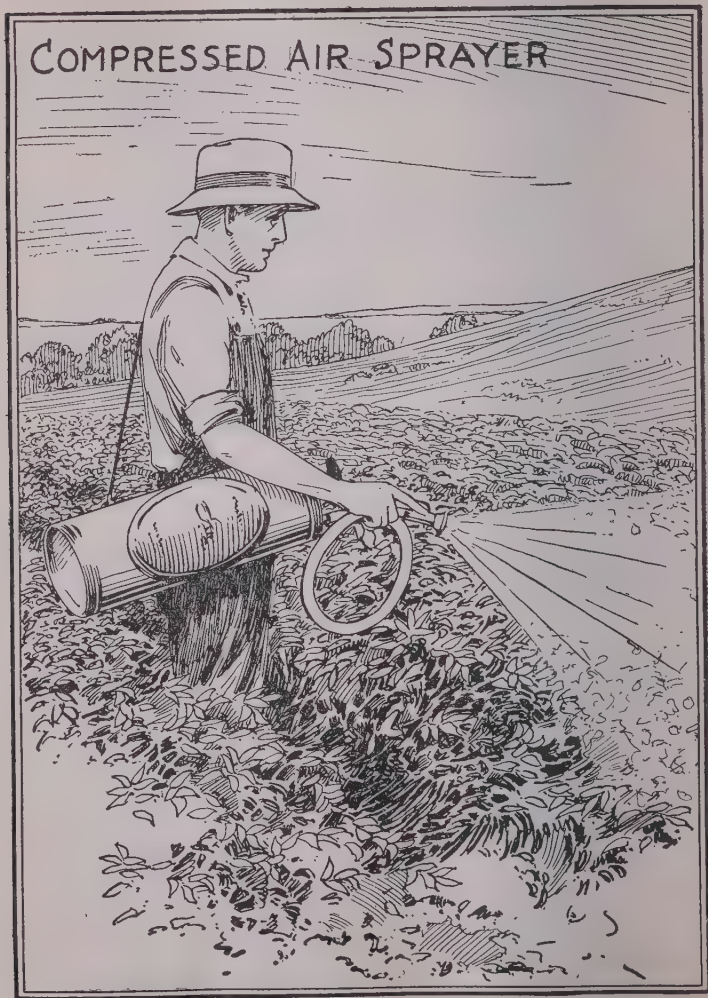
The favorite varieties are Duncan, Marsh Seedless and Walters.

In Florida the pomelo is a winter and spring fruit and in California it is a summer fruit.

Tangelos are hybrid fruits, crosses between the tangerine and pomelo. They have not attained a place of commercial importance.

Shaddocks, Pummelo, *citrus maxima*, are large, coarse-grained fruit borne singly, not in clusters. They are larger than the grapefruit, the tree is smaller and not so hardy as the grapefruit. They are not now of commercial importance.

COMPRESSED AIR SPRAYER



Chapter XLII

CITRUS FRUITS, LEMON, LIME, CIT- RON AND KUMQUAT

The Lemon is in bloom and bears fruit at the same time, throughout the season. It is more easily damaged by frost than other citrus fruits and its moisture requirements are greater. Lemon growing is considered more speculative than growing oranges. High-grade fruit must be produced, properly colored and cured. Lemon growing has been more successful in California than in Florida, although recently greater production has been obtained in Florida.

Stock.—The rough lemon stock is quite largely used for stock in Florida. The sour orange stock is also used. In budding, the buds are placed high on the stock, so the lemon will not come in contact with the soil, owing to gummosis.

Planting.—In California the trees are planted 20 to 30 feet apart and from 20 to 25 feet apart in Florida.

Cultivation is similar to the orange.

Pruning.—The aim should be to keep the head of trees low so the trees may be conveniently sprayed, fumigated, thinned and harvested. The fruit, however, should be kept off the ground. Regular pruning will be needed.

Harvesting.—The fruit is harvested while the color is green and this is an operation that may well be left to the Association pickers.

The fruit is cured after picking, to give proper color and increase the juice.

Curing.—The fruit is washed in a solution of $\frac{1}{5}$ of 1 per cent of copper sulphate or in hot water, and then stored in a shed with rooms partitioned off with canvas and having a canvas roof, with a space around each room. The rooms holding about a carload of fruit.

The fruit is stored in trays, so piled that there will be free air circulation. Curing requires thirty to sixty days. This time may be shortened to four to twelve days by sweating. The lemons are placed in a temperature of 90° F. and closely confined, with high humidity

Packing.—The fruit is graded and packed in boxes 10½x12x27 inches outside, after it has been wrapped in tissue paper.

LEADING VARIETIES OF LEMON

Eureka.—Medium size. Seedless. Tree half dwarf and free from thorns. Early; prolific. One of the best in California.

Everbearing.—Size medium to large. Seeds 19. Bears perpetually. Does well in Florida but is valuable only for home use.

Genoa.—Size medium. Seedless. Early. Good keeper. Tree dwarf and thornless.

Lisbon.—Size medium. Few seeds. Keeps well. Tree medium in size, vigorous and productive; thorny. Fruit ripens evenly. Bears one crop.

Ponderosa.—Size large. Resembles a pomelo. Seeds 25. Season winter. Used in the North for pot culture, for ornament.

Sicily.—Size medium. Seeds 12.

Villafranca.—Size medium. Seeds 30. Tree has but few thorns; productive. The leading variety of lemons in Florida.

THE LIME

Limes will do better on poor soil and stand more neglect, than any other citrus fruit, but also respond to good treatment. The trees will stand less cold than lemons.

Most of the trees are grown from seed. Better care given to growing and propagating would lead to better varieties.

Limes are usually planted 15 by 25 feet. The fruit is harvested throughout the year like lemons.

Varieties are offered under the names of Calamondin, Eustis Limequat, Kusale, Mexican, Rangpur, Tahiti and a similar variety to the last, in California, is called Bearss.

THE CITRON

The citron is a low spreading tree which will stand but little cold. The tree, like some lemons, blossoms and produces fruit throughout the year. The fruit is much longer than a lemon, with a very thick skin. It is grown for the candied skin or rind. It can be grown in California and Florida.

Propagation is by means of cuttings, layers, budding or grafting. It can be budded on sour orange or rough lemon.

Soil and culture is similar to the orange. The trees are planted 15 by 15 feet.

THE KUMQUAT

Kumquats grow ten to twelve feet high with an equal spread. They are grown in the Gulf States and in California and as far North as Augusta, Georgia. The fruit makes good marmalades, jellies and preserves and may be eaten raw.

The leading varieties are Hongkong, Marumi, Meiwa and Nagami.

*Chapter XLIII***TROPICAL FRUITS****AVOCADO**

The Avocado, *Persea*, called "alligator pear," is native of both South and North America and is now grown commercially in Southern Florida and in California. The fruit has long been popular in Mexico and South American countries.

The fruit of commercial varieties somewhat resembles a large pear. The flesh is eaten from the inside, after removing the one large seed it contains.

The trees bear the third year from seed. Seedling trees grow fifty to sixty feet high. Budded trees do not grow more than forty feet high and often less. Trees in full bearing produce on an average from 400 to 600 fruits.

The tree cannot thrive where it is subject to heavy winds. Where irrigation is practiced it should be discontinued early enough to allow the wood to be well matured before cold weather. The avocado likes a humid atmosphere. It is not so particular regarding soil, as drainage, which must be good.

In planting, budded trees are used that have been grown for a year in the nursery. They are transplanted the next spring and are balled when dug, so as to keep the roots intact. The trees are sometimes transplanted in Florida without balling, by very careful handling. The foliage is entirely removed, the trees pruned and the roots kept wet until replanted and watered. The trees are set from 20 to 30 feet apart. In California 24 to 30 feet is the usual distance and in Florida 20 to 26 feet. Very spreading varieties may require 50 or 60 feet.

Planting in Florida is done in the autumn, September and October. In California December, January and February are considered the best months for planting.

In Florida the trees are kept mulched throughout the year with straw, seaweeds, weeds or available material, spread out as far as the branches reach. In California the trees are cultivated quite like citrus fruits, but the cultivation must be very shallow.

The trees are headed back about three feet from the ground to induce spreading, and weak or unshapely limbs are removed and the wounds carefully treated with Bordeaux paste or paint. Autumn and winter is the pruning season in Florida, and in California, autumn or spring.

Organic nitrogen is the best fertilizer which is obtained by growing velvet beans or a similar crop. From five to ten pounds of a fertilizer containing 3 per cent. nitrogen, 5 per cent. phosphoric acid, and 5 per cent. potash is applied per season to each tree, only a little is used at a time.

The fruit is graded according to size. Below five ounces in weight is considered very small; from five to eight ounces small; from ten to fourteen ounces medium; from sixteen to nineteen ounces large, and from nineteen to twenty-four ounces very large.

Propagation is by means of budding on seedlings. The seeds are planted soon after being removed from the fruit, in boxes or pots about 4 inches in diameter, in light, porous soil. The seeds are planted with the pointed end just at the surface. The pots are set in frames packed in litter, which is kept moist. The plants are protected by glass or lath shades. When the seedlings are 6 inches high, they are set out in nursery rows. The seeds may be planted in the open ground in rows about 3 feet wide, the seed set 14 or 15 inches apart in the

row, and the soil watered often enough to prevent its drying out. Seeds of Mexican varieties are used in California, being hardier than others.

The soil for young plants should be rich and well drained. The stock may be budded when it is a trifle less than half an inch in diameter. Shield buds are cut an inch and a quarter in length from a twig half an inch in diameter. If the stock is large, the buds should be longer. The budding should be done when the bark slips well. May and June is a good season in California, but in Florida autumn is the season when most of this work is done, the buds remaining dormant until spring.

Plump, fully developed buds should be taken from wood of recent growth. Fuerte and Taft bud well; some varieties do not.

The tape that holds the bud will need loosening in about three weeks, but the tape should remain until the bud has made 3 or more inches of growth. It will be necessary to go over the stocks carefully removing all buds that start, except the bud that has been inserted in the stock. As soon as the bud has made 8 inches growth, the stock is trimmed back close to the bud and the wound covered with grafting wax. The tree should then be staked. Bud variations may sometimes occur, the growth from the bud producing fruit somewhat different from the parent plant.

Harvesting.—Orange clippers are used for harvesting, cutting above the swollen portion of the stem. The fruit must be picked and handled carefully, as bruised fruit is not marketable. The trees are easily injured and ladders cannot be safely used. Special avocado pickers are made, bags on long bamboo poles for picking one fruit at a time. Fruit ripened on the tree has the best flavor, but it will ripen off the trees and may be picked a week or a little more before it is ripe. The fruit is shipped so as not to be over-ripe when reaching market.

The fruit is carefully graded into uniform sizes and wrapped in heavy paper, packed carefully in excelsior, so as to prevent moving, one layer in light wooden boxes.

Persea drymifolia (the Mexican race) includes the small, thin skinned varieties grown in California. These can be depended on to thrive where oranges grow. The foliage has an odor and taste of anise. They are hardier than others.

Persea americana lack the anise odor and taste in the foliage. Most of the varieties grown in Florida are of this class. This is the South American or West Indian race.

The Guatemalan race have thick, shell-like skins and ripen from late winter to mid-summer. They are not as hardy as lemons.

By proper selection of varieties, fruit can be had throughout the year. Cross pollination may be necessary with some varieties. Some varieties, like Northrop, produce two crops a year.

VARIETIES

Growing avocados commercially is a comparatively new industry and many new varieties will probably be introduced. Only the standard varieties now grown are given.

Mexican Thin Skin Varieties

Chappelow (*Persea drymifolia*).—Purplish-black. Medium size. Seed small. Flavor excellent. Tree vigorous, hardy, productive. August to November in California.

Ganter.—Green, oval fruit. Medium size. Seed small. Flavor excellent. Tree hardy and prolific. October to December. This was the most popular variety in California, but is giving way to newer varieties. Fruit subject to decay at neck.

Gottfried.—Brownish-purple, pear-shaped. Large, 12 to 20 ounces. Small seed. Fine flavor. August to October. Hardy in Florida.

Northrup.—Purplish-black. Pear shape. Medium to small. Seed medium. Tree hardy, vigorous and prolific. Produces crop in October to November and a small crop in spring.

South American or West Indian *Persea Americana*

Barker.—Green, pear shaped. Very large, up to 3 lbs. Small seed. Flavor rich. Tree vigorous, not very prolific, but harder than Pollock. August-September in Florida.

Family.—Maroon. Pear shaped. Large, 10 to 14 ounces. Large seed. Flavor good. Tree vigorous and productive, but tender. July to September in Florida.

Trapp.—Pale green. Round. Large, 14 to 20 ounces. Flavor rich. Seed large. Trees are dwarf and bear at early age and are prolific, but tender. October to December in Florida.

Hard Shelled, Guatemalan

These are grown to a limited extent at the present time in California.

Blakeman.—Green. Pear shaped. Large, 16 to 20 ounces. Seed medium. Flavor rich. Tree vigorous grower, fairly hardy. May to July.

Colorado.—Dark purple. Egg shaped, 14 to 18 ounces. Seed medium. Flavor rich. Tree somewhat weak and only moderately productive. Difficult to bud.

Eagle Rock.—Green. Round. Very large, 20 to 40 ounces. Flavor delicious.

Fuerte.—Green. Pear shaped, 12 to 14 ounces. Seed small. Flavor rich. Tree vigorous, prolific and hardy; propagates well. January to August.

Linda.—Purple. Round. Very large, 32 ounces. Seed medium. Flavor excellent. Tree vigorous, productive and hardy.

Meserve.—Dark green. Oval, 14 to 16 ounces. Flavor rich. Seed medium. Tree productive. April to June in California.

Nimlih.—Green, oblong. Large, 24 to 40 ounces. February and March. Seems to be a good variety for Florida.

Puebla.—Purple. Pear shaped. 8 to 10 ounces. Rich flavor. Tree prolific and hardy. December to February in California.

Solano.—Green, oval, 16 to 24 ounces. Flavor good. Seed small. Tree vigorous and prolific. March to May in California.

Spinks.—Dark purple. Round, 26 ounces. Seed small. Flavor rich. Tree is prolific and bears at early age. April to August in California.

Taft.—Green. Pear shaped. Medium size seed. Rich flavor. Tree vigorous, productive and hardy. May to October in California.

Walker.—Green. Pear shaped. Fruit small, 5 to 8 ounces, but of rich flavor. Seed large. Tree vigorous and productive. Propagates easily.

THE BANANA

The Musa is supposed to have received its name from Antonio Musa, physician to Octavus Augustus, first emperor of Rome, 63 B.C. The banana in the North best known by the variety grown for ornamental purposes on account of its tropical foliage, is *musa ensete*, or Abyssinian banana. There are many varieties. *Musa sapientum* is the large red and yellow banana, common in our markets. *Musa Cavendish* is a dwarf variety, hardier than most others. Some varieties are grown solely for their fibre.

Bananas are grown in California, in Florida, and some other Southern States.

Bananas like a rich, light, well-drained soil. It should be plowed deeply before planting and well cultivated after planting. Heavy frost will kill the foliage, but unless the roots are frozen, growth will start again. Ample rain is required, not less than an average of 60 inches.

Garden plants can easily be supplied with water. Where the soil is good, fertilizers are not required, otherwise a fertilizer is given that will average 50 lbs. of nitrogen, 75 lbs. acid phosphate and 100 lbs. of potash per acre.

Propagation.—Edible bananas are propagated by means of suckers that spring from the base of the plants, somewhat after the order of cannas. When the suckers have become well rooted they are cut off and transplanted, first cutting off the top, leaving a stub about six inches long.

Another method of propagation is by cutting the roots into pieces and planting them in light soil in a sunny location, and covering with sand or leaf mold. The soil must be kept moist. As soon as a leaf or two has started, the plants are set out where they are to develop.

The plants are set in rows from twelve to eighteen feet apart and about twelve feet apart in the row. They are thoroughly watered as soon as planted, and cultivation is started immediately. A mulch can be given advantageously.

The first crop is produced in a year after planting. Two to three suckers are allowed to grow. The suckers that are permitted to develop are depended on for the succeeding crop.

The suckers that remain should be of different ages. Not more than four main stems are allowed to each plant.

The fruits in one cluster are called hands, the fruits fingers. Nine to twelve fruits make a good hand and from six to twelve hands a good bunch. A bunch of nine hands or more is a first; seven to nine, a second. Unusually large bunches do not ship well and are therefore undesirable.

Each trunk bears one bunch. The low growing plants are cut off about six feet above the ground and the bunch caught carefully. The stems are cut up and left for fertilizer. The stubs dry up and are pulled out. Palm poles with knives attached are used for cutting the tall growing plants, about eight feet high; the cut is made only part way through the stalk, which falls over gradually. The bunch is then severed.

Plants are started so the crop will be ready when market prices are highest. The fruit is sold by weight.

Replanting is done every three to seven years.

The fruit is picked at least two weeks before it is ripe and hung in a cool place to ripen.

VARIETIES

Cavendish.—A dwarf variety, does well in Florida.

Cuban Red.—The common red variety of our markets.

Martinique.—Jamaica or Great Michael. The common yellow variety of our markets. Can be grown in Southern Florida.

Hart.—Can be grown throughout Florida.

Orinoco.—Another hardy variety that can be grown throughout Florida.

THE DATE

The date is adapted to commercial culture only in localities having a high temperature and low humidity. Almost no amount of heat or dryness is too much for the plants, if the roots have sufficient moisture. At Tucson, Arizona, only very early sorts ripen. It is reported that some varieties, when dormant, will stand a temperature as low as 20° F. The trees bear either male or female flowers. Usually about one staminate tree is necessary for about twenty-five pistillate trees. The trees are very long lived and bear for a hundred years or more. As many as 20 clusters, each weighing from 30 to 40 pounds, may be borne at one time. Irrigation is required unless there is ample moisture in the soil, which is hardly likely where the temperature is sufficient for the date to fruit. The soil must be wet down deeply especially in the spring, before blooming and later as the fruit matures. Less water is required when blooms appear and when the fruit is first forming. An excess of water then may prevent production of a crop.

In irrigating the water is applied at night to avoid the heat of the sun. Hot water may be injurious. Cultivation must follow irrigation to prevent the soil baking.

An ample supply of humus must be kept in the soil by growing crops of some kind to turn under.

Propagation is by means of suckers which develop about the base of the plants while they are young. The sucker will be

of the same sex as the parent. In California and Arizona the suckers are removed when about six inches at the base. It is partly cut and then banked with soil and watered to induce rooting. The sucker plants are cut off from February to May. The inner leaves cut back about half way and the outside leaves still more. The plant is then allowed to lie on the ground under the parent for ten days, when it is planted in a hot bed, generating heat from manure, where it is regularly and liberally watered for fully six months. Then the watering may be reduced to once a week. When the plants have sent up two sets of leaves, and a third set is beginning to develop, it is transplanted. Some plants will not start to grow for three or four years.

Planting.—Four or five days before transplanting, the leaves are cut back about half. Holes are made to receive the plants, three feet deep and two feet wide. A foot of manure is thrown in and 6 inches of soil on this. Water is turned in, wetting thoroughly. The young date palms are dug in April or May with a ball of manure to keep the roots intact and planted just so as not to cover the bud. The plants are irrigated at least twice a week. The plants are set 30 by 30 feet. Some varieties are given more space.

When the plants are in bloom, sprays of the male flowers are cut and tied above the female blossoms.

THE GUAVA

The guava, *Psidium guajava*, can only be grown in the warmest sections of California and Florida. The strawberry guava, *Psidium cattleianum*, is as hardy as the orange. The feijoa or pineapple guava, *feijoa sellowiana*, closely related to the guava,

is hardier than most other sub-tropical fruits, the trees growing about 18 feet high.

The fruit is green, with a little crimson. They are delicious raw and may be stewed and used for jams and jellies.

The soil should contain ample humus and be free from lime.

Propagation is by means of cuttings, made from the young wood at the ends of the branches. These are rooted in sand in a propagating bed in a greenhouse, with bottom heat. Some cover the cuttings with glass in the propagating bench. They are rather slow in rooting, requiring a month or two before they can be taken from the sand.

Layering is also practiced. Low branches are bent down and six inches of the branch covered with earth, kept damp, to induce roots to start.

The trees are set 18 feet apart, at least three should be set out together to insure pollination. The trees should be well watered when first planted and mulched.

The fruit is permitted to hang until good flavor is developed and then stored in a cool place to condition. When mature the fruits drop from the tree.

The guava, *Psidium guajava*, is grown in Southern Florida and in Southern California, reaching a height of 30 feet, bearing fruits about 21 inches in diameter. The flesh is sweet or slightly acid and is eaten raw, stewed and used for jams and jellies.

The strawberry guava, *Psidium cattleianum*, is the one most generally grown in California, where it is said to have stood temperatures as low as 20° F. The fruit is small, about 1½ inch in diameter, with numerous seeds. The flavor is considered somewhat similar to the strawberry. The tree grows to a height of about 20 feet. The plants are set 10 by 10 feet apart.

THE FIG

The fig is a deciduous, sub-tropical tree. Along the Atlantic Coast, some varieties are grown as far north as Norfolk, Virginia. It is grown all along the Pacific Coast from Oregon to California. Early winter freezes will kill the twigs and branches for the first two or three years. In California, cornstalks are set up around the tree trunks and among the branches for protection. Older trees are whitewashed to prevent sunscald.

The fig can, with a little care, be grown over a wide territory for home use. It can be grown and fruited as far north as Rochester, New York, in tubs or pots a foot or more in diameter. The tubs removed to a cool cellar before frost and kept there until after freezing weather the next spring. In the same locality, the trees can be planted in the open ground and in the late autumn, before hard frosts, the trees bent over to the ground, covered with straw and tied with cords, laced back and forth to pegs firmly driven in the ground. The straw is then covered with earth. The earth and straw, keeping out the frost. In the spring the trees are uncovered and straightened up.

For commercial purposes, the fig requires a climate varying with the variety. Those used fresh do not require as warm a climate as those grown for drying. Mature tender varieties will stand a temperature of 16 degrees F.

The fig requires plenty of water. Twenty-five inches of rainfall during the winter and none in the summer is ideal, particularly where the nights are warm. Rain, dews and fogs are detrimental when the fruit is ripening.

Soil.—Figs thrive in rich loam, well drained, and free from acidity. Alkali soils will produce fruit that may be used fresh, but it will lack sufficient sugar for drying.

For pot culture, use plenty of broken crocks or bricks in the bottom of the pots for drainage. For soil use two parts good rich loam, one part sharp sand and one part old mortar, from some old building, crushed, and the whole thoroughly mixed. Pinch back the new shoots as soon as they are three inches long, to force new shoots to grow which will produce the fruit.

For forcing in a greenhouse the plants are repotted in the autumn and kept in a cool house during winter, and are started into growth in a temperature of 50 degrees late in the winter, later given ten degrees more heat. They can be set outside when the nights are real warm or they may be fruited under glass.

For forcing, White Ischia, Brown Ischia, Negro Largo and Marseilles are used. While for outside planting in the North, Brunswick, Brown Turkey and Marseilles are good.

Planting.—In the South, the trees are set 10 to 15 feet apart in the rows and the rows are set 12 feet or more apart. In some sections where growth is favorable the trees are set as far apart as 20 feet each way. In planting it should be remembered that the roots spread out far beyond the branches.

In planting, the usual caution must be repeated and with emphasis, not to let the roots dry out. Have the holes large enough so the roots may be spread out in their natural position and firm the soil well about them. Set the trees an inch deeper than in the nursery.

Cultivation should be given as soon as growth starts and continued until about July, when a cover crop is sown to be turned under in the winter. Velvet beans may be used for a cover crop, but seldom is it safe to use cowpeas as they are subject to nematodes and eelworms which are very injurious to figs. Where nematodes are troublesome, mulch the plants

with bricks, stones, or similar material rather than resorting to cultivation.

The fig is shallow rooted and deep tillage is injurious. Tillage must be very shallow or mulching resorted to in place of tillage, but weeds must be kept down.

Figs are grown in bush form, except in California where the fig is sometimes grown in tree form, attaining a height of sixty feet or more. Three or four main stems are encouraged and only a little pruning is desirable, just before growth starts.

In the East, the fruit is produced in the axils of the leaves on wood of the present season's growth, and pruning, when necessary to encourage new growth for the production of fruit.

The plants purchased from nurseries are usually a single stem or whip, which should be cut back to about 16 inches, or left longer, according to the variety.

The fig as usually grown in the Southeastern States will set its fruit without pollination, but it may be pollinated. The Smyrna figs will not set fruit without pollination, included are Rixford and Calimyrna. The San Pedro figs, including Gentile and White Pedro will set a first crop each year without pollination, but the second crop requires pollination to keep it from falling. The Capri figs are important for pollinating other varieties. The pollen for figs is supplied by the Capri figs and is spoken of as caprifigation.

The fruit of the fig is hollow and the flowers are borne on the inside surface of its fleshy walls. It is the reverse of the strawberry or like a strawberry with the outside turned in.

In the Capri fig there are stamens near the opening of the fruit. Back of the opening are pistils, known as gall flowers. The Capri figs are inhabited by a small wasp (*Blastophaga grossorum*), which deposits its eggs in these gall flowers.

Capri figs which are borne on a single tree during a season are called profichi, figs that start from wood one year old or older, about the time the leaves start in the spring. Mammouis are figs that start in the early summer in the axils of the leaves of the current season's wood, and manime, the same as mam-moui, except that they start later in the summer. It is in these last named that the blastophaga live through the winter. The pollen is carried from the profichi to the young Smyrna figs. The adult female becomes covered with pollen in going out of the capri fig and carries it to the young fig which she enters to deposit her eggs. If she enters a Smyrna fig there are no gall flowers and she dies, but the pollen is applied and a fruit results.

To insure pollination the capri figs are gathered, placed in baskets and hung in the Smyrna trees. Caprification begins when the Smyrna figs are a little less than half an inch in diameter. The capri figs are hung in the trees every three or four days over a period of three weeks.

The Smyrna figs are carefully watched and the time for caprification is told by the color of the figs. When the fruit appears waxy is the time the capri figs are distributed through the trees.

The figs are picked by hand at daylight early in the morning, while the figs are cool, because the wasps leave as soon as the figs become warm. Six to a dozen figs are used for trees up to six years old and fifty to one hundred for trees ten years old or older. For small trees, one basket is used; for large trees two to four baskets are hung in different locations.

One or two Capri trees are planted for each one hundred Smyrna trees.

Figs are propagated from cuttings. Well matured wood of the previous season's growth is generally used. The cuttings are made in the autumn about eight inches long, the base being just below a bud or node. The cuttings are stored in damp sand over winter, and set out in rows in the spring. Single eye cuttings are sometimes used but these are started in a cold frame.

Furrows are made about 6 inches deep and in these the cuttings are set about 8 inches apart, so that the top bud will be just above the surface. The soil must be well firmed about the cuttings or they will fail to root. These are grown as planted for a year or two years before transplanting.

Figs must be harvested as soon as they are ripe in damp or wet weather or where the humidity is high. The fruit will rot if left too long on the trees. When fully ripe, the fruit is soft and is then ready for the table. For shipping or preserving, figs are picked before they begin to soften, but just as they are about to soften.

The harvesting is done in the early morning. The firm fruits of good color are packed in strawberry baskets and shipped, but the bulk of the fruit is canned, preserved or dried.

Ten quart pails are used for picking and the pickers use rubber finger cots or rubber gloves. The juice from the stems irritates the skin, so the hands and arms are rubbed with grease for protection. Canners buy figs according to grade.

Figs are shipped in limited quantities to the New York and other eastern markets. They are carefully packed in single layers, each fig protected by corrugated strawboard, in light wooden boxes.

Insects.—The three lined fig tree borer lays its eggs from spring until autumn. When the young hatch they bore through the bark, which occupies them a little more than two weeks. Then they bore into the wood where they remain for two or three months, after which they emerge.

The eggs are laid on trees where the bark is damaged or where there are wounds and preferably in dying wood. All wounds should be carefully smoothed off and protected by painting with five parts coal tar and one part creosote or crude carbolic acid, covering the wood only, not the bark. Give two additional coats as soon as the first, and then the second, is dry.

The borers may be dug out of fig trees with a stiff wire. Cut out and burn trees that borers have got the best of. Also destroy diseased trees.

Nematodes are troublesome in the South, eating the roots and causing nodules on them. They are most troublesome on light soil.

The June beetle does serious damage at times in the West.

Diseases.—A troublesome disease of the fig is rust, which causes the leaves to drop. Spraying with Bordeaux mixture at 4-5-50 strength in the dormant season and again before growth starts, continuing every two weeks during the growing season.

Soft rot occurs during warm, humid or wet weather. No effective remedy is known at present. Celeste is less likely to be troubled than other varieties. The trees should be pruned to let in full sun. Gather the fruit as soon as ripe.

THE LOQUAT

The loquat is an evergreen tree, a native of China, which grows to a height of twenty to thirty feet. It is grown commercially in Florida and California. The flowers are not often killed by a temperature of 27 degrees F. Trees are reported as thriving where the temperature has dropped as low as 10 degrees F.

In California the flowers appear from October to January and the fruit sets during the winter and ripens in the spring. The young fruit may be killed by cold. The seed of the fruit is particularly tender and may be killed, although a seedless fruit may be produced. The fruit is most likely to be injured as it is beginning to color.

The fruit is pear shaped and about three inches long. The salmon flesh is juicy and firm. The fruit is eaten raw and used for preserving, etc.

Loquats will grow on a variety of soils, but rich, moist soil is best. Sandy soils are unsuitable. Irrigation is used in the West.

Planting is usually done in the spring, setting the trees 20 feet apart, pruning the head back severely. In California, where irrigation is used, the trees are set 12 feet apart in the rows, and the rows about 20 feet apart.

The loquat is not cultivated while the crop is maturing. Cover crops of legumes are used and heavy applications of stable manure. The soil must be kept high in fertility.

The trees are pruned to form 3 to 5 main limbs, and shaped quite the same as the apple. In bearing trees, broken or dead

branches are removed after the crop has been harvested, the head being kept somewhat open to admit sunlight.

The fruit is borne on wood of the current season's growth. Large fruit is obtained by thinning when the fruit is small.

The fruit is sometimes damaged by birds and is protected by bagging in the same manner that grapes are bagged.

In a week, or a little more, after the fruit is well colored, the fruit is gathered with clippers. The trees beginning bearing when five years old.

Propagation is by means of budding or grafting on seedling stocks. Budding is done in October and November. Buds are used from new wood which has dropped its leaves, the bud being cut 1½ inches long. When the bud is united, the stock is cut off 3 inches above the bud. Grafting is the usual method in Florida.

The loquat is an important commercial fruit in Japan. The Japanese varieties are smaller, more slender, and the flesh and skin lighter colored than the Chinese and the seeds are smaller. The Japanese varieties include Champagne, Early Red and Premier. They ripen earlier than the Chinese varieties.

The Chinese varieties have larger fruits than the Japanese, the skin and flesh are darker. Popular varieties are Golden Nugget or Tanaka and Thales.

The loquat is subject to attacks by aphid, codling moth and scale. Spray as for these insects on apples.

Black spot sometimes appears on the fruit. Spray with Bordeaux after the blossoms fall. Anthracnose may injure the flowers. Spray the buds with Bordeaux 3-3-50.

THE MANGO

The mango is the fruit of fruits. It has the delicious flavor of bananas, muskmelon and other choice fruits combined and excels them all, when well grown and properly ripened. Unfortunately, in America the territory in which the mango can be grown successfully is exceedingly limited. The trees may stand a temperature of 28 or 29 degrees F., but they are better off where the thermometer never falls so low as to reach the freezing point.

The mango has not done well in California and only in the warmer parts of Florida. Porto Rico seems to be the place where we can grow this fruit. The trees need an abundance of water, except when in bloom and when the fruit is forming and ripening, at which time almost none at all is required. Deep, rich light soils are suitable, although heavier soils answer, if well drained.

Planting.—The trees are planted thirty-five feet apart, in April or May. Planting size trees are 3 feet high and $\frac{1}{2}$ inch in diameter. The trees are thoroughly watered when planted and shaded. In California irrigation is required. The cultivation is the same as for citrus fruits. The trees begin bearing three or four years after planting. We have much to learn regarding growing mangoes successfully.

The fruit is harvested when mature, by cutting with shears, a short stem being left on the fruit.

Each fruit is wrapped in paper and packed in baskets holding six or twelve. A layer of excelsior is placed below and above the fruit and the baskets shipped in tomato crates.

Propagation may be by means of budding, grafting or inarching on pot-grown seedlings. The seeds must be planted within a week or two from their removal from the fruits. The

seed husk is removed before planting. Only the strongest shoot from the seed is allowed to grow. Seed sown in summer in 5-inch pots will produce plants that will be ready to set out in the autumn or the following spring.

The buds are cut from wood below that of recent growth and about the same age as the stock. The bud is bound with tape made of muslin soaked in grafting wax. When the union is completed the top of the stock is cut off three or four inches above the bud.

For inarching the seedlings are grown in boxes or pots until a year old. When the seedling is $\frac{1}{2}$ inch in diameter, the box containing it is securely fastened in a tree so that a suitable twig can be grafted. About a foot below its terminal bud, the bark of the twig is removed about 3 inches along its side. About 6 inches from the base of the seedling a similar piece is cut. The two cut sections are brought close together and bound with the grafting waxed tape and this is then covered with grafting wax to keep out all air. When the union takes place the top of the seedling is cut off and the cion cut from the tree and the plant is ready to set out.

Pollination is a matter that requires greater study. Mangoes have many flowers while only a comparatively few are perfect flowers. Some insect may be needed for pollenizing the flowers.

Fruit flies are sometimes troublesome. So far the control has been by poisoning when the flies live on the foliage.

Leading varieties are Alphonse, Amini, Cambodiana, Eleanor and Sandersha.

THE OLIVE

The olive is a long lived evergreen. Olives are grown commercially on a large scale in California, back from the coast, and in Arizona and in New Mexico. The trees have stood a

temperature of six degrees F. and though young trees were frozen to the ground, old trees had only the foliage and new wood injured. The blossoms will be killed by heavy frosts and the fruit injured by a temperature of 26 degrees.

The olive requires a dry climate, without rains at blossoming and ripening time, with a long summer season.

The soil should be light, warm, rich, moist and well drained, with plenty of lime. In dry regions regular irrigation is necessary.

Planting.—The trees are planted from 25 to 35 feet apart. Constant cultivation is given until autumn, when a cover crop is sown. Fertilizer may be applied both in spring and autumn.

When young trees are planted they are cut back to about 2 feet in height. Four or five branches, shortened in to 4 inches are left and the leaves removed. Thereafter the trees are pruned as needed to keep them in good form, and yearly pruning is needed to take out surplus growth. A good crop is expected in five or six years.

Harvesting.—The crop for pickling is harvested in October. For ripe pickles they are picked when purple. For oil they are not picked until they turn black, just before they begin to soften. For pickling the fruit must not be bruised.

For oil, the fully ripe fruit may be pressed as soon as harvested or is spread on trays, and not more than 3 inches deep. If the trays are piled, air spaces should be provided between them.

The fruit is crushed by rollers and then pressed. Light pressure is given the crushed olives first for the first grade oil. Then a second pressing is given, yielding a second grade oil. A third pressing produces a third grade oil and finally a fourth pressing produces oil that is used for making castile soap. The dry pulp or pomace is used for fertilizer.

Poor fruit or over-ripe, spoils the oil. Frozen olives should be picked and pressed before twenty-four hours. A ton of olives will produce about thirty-five gallons of oil.

Propagation.—Olives are propagated from seeds, tips, cuttings, suckers, layers, budding and grafting, the two latter methods considered as producing most desirable trees.

The shell of the olive seed is hard and unless treated, two years may be required for germination. The seed may be soaked from twelve to twenty-four hours in a solution of ten per cent. caustic potash. The seeds must be removed from the solution before it reaches the kernel. They should then be stratified in moist sand until March or April and then planted in the nursery bed. When two years old the seedlings are transplanted into nursery rows. These are budded or grafted the following year.

Tip cuttings are easily rooted. They are made from lateral branches about 4 inches long. Remove the lower leaves and some from the upper portion. These are inserted in sand, the sand firmed well about them. When well rooted, set out in nursery rows.

Cuttings can be made from wood $\frac{3}{4}$ inch in diameter and a foot long, from branches that are two or three years old, planted immediately in nursery rows. Layers root readily. They are made by cutting a long slice, 3 inches long, half way through the limb from the under side of the branch and covering it with earth.

Mission is the most popular variety. Ascalano and Sevillano bear large fruit.

Olive wood works up well and takes a high polish. It is useful for many ornamental purposes.

The botanical name of the olive is *Olea europea*.

THE PAPAYA (PAWPAW)

The papaya, *Carica papaya*, is grown in Southern Florida but has not done very well in California. The fruits vary from a small size, 4 or 5 inches long, to 2 feet or more in length. The plants may grow 20 feet or more in height.

The fruit is eaten raw as a dessert or salad. It is cooked and used for preserves, etc.

The plants are rank growers and gross feeders, requiring ample nitrogen and humus in the soil and plenty moisture. Good drainage is essential.

Some plants bear male flowers, other female and some both male and female flowers. The female flowers must be pollinated by insects to insure a crop of fruit.

Plants are grown from seed; the seeds covered with soil about half an inch and potted when the third leaf develops. When well under growth the plants are set out. Seeds started under glass in February will be large enough to set out in March. The plants are set 10 feet apart, one male to ten females. The trunk is unbranched usually, and has leaves on long stems on its summit. If branches are produced, they may be cut off and rooted, treated as cuttings.

The tree is a rapid grower, but usually does not bear well for more than three or four years. The fruit ripens from December to June and is gathered as soon as it turns yellow. It is difficult to ship long distances.

THE PINEAPPLE

The pineapple, *Ananas sativus*, is native of tropical America. In Europe it is grown as an ornamental plant in greenhouses. When a year old or more, the plants produce a tall flower stalk which produce a compound fruit. The fruit has a crown or top of leaves in rosette form. When the top of leaves is cut off in preparing the fruit, if it is set on a pot of sandy soil in a warm sunny place, it will form roots. Care must be exercised in watering the plant not to get the water down in the foliage or the top will rot and the plant die.

A flower stalk bears but one fruit although some plants produce two fruits on different stalks.

Pineapples are grown in a limited way in Southern Florida, but the bulk of our supply comes from Hawaii, Cuba and the West Indies.

Pineapples should be grown where the temperature does not fall below 30 degrees F. A dry, sandy soil rich in humus and well drained is needed. The soil must be free from lime and manganese.

In Florida the crop is fertilized heavily with ground bone and basic slag. Dried blood and cotton seed meal are used for nitrate. A low grade sulphate of potash and tobacco stems are also used.

Half a ton per acre of a fertilizer analyzing 5% nitrogen, 4% phosphoric acid and 10% potash is recommended about six weeks after planting. Repeat every three months for the first eighteen months. Then make two applications a year of 1,200 pounds, one in February and another as soon as the summer crop is cut. Others apply 1,000 lbs. of tobacco stems per acre in the autumn in addition to the fertilizer.

Eight thousand to fourteen thousand plants are set to the acre. Beds are made from 6 to 8 rows wide. This permits

hoeing without walking in the beds. Porto Rico is set 30 inches apart; Red Spanish 18 inches and Queen 20 inches.

As soon as possible after planting about a tablespoonful of cottonseed meal is put in the base of the leaves of each plant to keep out sand.

In the two weeks before the fruit ripens the sugar content increases up to more than 12 per cent. Fruit harvested green does not develop additional sugar when it changes color.

The Abachi, Cayenne and Porto Rico varieties are cut off with a knife and those picking the fruit wear mittens and leg-gins for protection from the dagger like, saw-edged foliage.

The fruit is graded and packed in crates from 18 to 48 to the crate.

Propagation is by means of suckers, crowns, slips and stumps. Suckers are small plants that appear in the axil of a leaf below the fruit stem. A plant that has produced a fruit early in the season will produce several suckers by autumn. Slips are small plants which develop immediately below the fruit. Plants from slips take a year longer than suckers to fruit. Crowns are the top leaves on the fruit. Crown plants take two years to grow fruit. Fruit is always shipped with the crowns on. Crowns are obtained only from fruit used at home or at the canning factory. Stumps produce vigorous plants; they are wholly buried in sand.

The Spanish varieties are largely grown in Florida. The flesh is white, the plants healthy, the fruit maturing from June to August, of medium size. Adapted to field culture.

The Queen varieties have yellow flesh, rich sweet flavor, but are not suitable for field culture. The varieties include: Abachi, Black Ripley, Egyptian, etc.

The Cayenne varieties have light yellow flesh. Strong, up-right growers.

Diseases and Pests.—Red wilt or blight has been troublesome in Florida, causing the tips of the leaves to turn red and wilt. It is due to nematodes, minute soil worms, troublesome in the South. Sow the land to velvet beans, natal grass or iron cow peas, to starve out the nematodes and to add a large amount of humus to the soil.

Red spider sometimes troubles the base of the leaves, causing them to rot. The remedy is tobacco dust in the bud and repeat in a week.

Mealy bugs work on the buds, slips and at the base of the leaves near the ground. Apply tobacco dust or spray with fish oil soap. This same spray will suffice for scale which may appear under the leaves.

THE POMEGRANATE

The pomegranate can be grown as a shrub or a tree, according to the treatment given. The foliage is attractive and the red or white flowers add to the beauty of the plants, which are in bloom all summer. The fruit ripens from September to November, and may be allowed to hang for two months. The red-flowered plants produce the most desirable fruit. Left to themselves the bush form results. If the suckers are removed the tree form may be developed. The plants are sufficiently attractive to make good greenhouse specimens, grown in tubs in cold regions. In the open the plants have stood a temperature of 15 degrees F.

The fruit is the size of an average orange, having a tough skin of various shades of yellow, pink and red.

The pomegranate is grown in a limited way in Florida, Georgia, Alabama, Mississippi, California, Arizona and some other sections. The public has not been educated sufficiently in the use of this fruit to have created a very active demand.

The best flavored fruit is from the warmest sections of the country.

Plants used as hedges are set 6 feet apart. Grown in tree form or in orchards, they are set 15 feet apart, set early in the spring.

Soil.—The land should be well prepared before planting and cultivation should be continuous to retain moisture. Irrigation may be needed in California. The pomegranate requires about the same amount of water as peaches.

Pruning is required to remove branches which interfere with each other and also to produce new wood, when the old wood is no longer productive.

The fruit is gathered somewhat before it is ripe, as it is apt to split when fully ripe. It is cut off, care being taken not to injure it in any way. It is then wrapped and packed, from 24 to 110 in a box.

Propagation is from seed, layers and cuttings. To perpetuate a variety the two last methods only may be depended on. Hardwood cuttings a foot long and about $\frac{1}{4}$ inch in diameter are made and set in nursery rows, firming the soil well about them. The cuttings are spaced 8 inches apart in the rows and set so the top bud is exposed. Soft wood cuttings root readily in propagating beds under glass and may, with care, be rooted in the open ground by keeping them from drying out and somewhat shaded.

*Chapter XLIV***INSECTS—SPRAYS**

Insects are disseminators of diseases in both animals and plants and should be controlled.

Not all insects are injurious, many are very beneficial. Silkworms allow man to make silk fabric. The powdered bodies of cochineal furnish a red coloring which enable women to redden their lips (probably not knowing what they are using). The value of honey and wax produced by bees, as reported by the last census is about \$6,000,000 annually in the United States alone. Bees also are very valuable in pollenizing flowers so the plants will produce fruit and seed.

Predaceous Insects.—Some insects, known as predaceous insects, catch and devour other species for food. They are of great value in aiding the fight against our insect foes. The ladybird beetles are notable examples.

Parasitic Insects.—There are other insects, known as parasitic insects, that live on or within the eggs or bodies of other insects. They are very useful to man in his effort to control injurious insects that multiply with astonishing rapidity.

Birds are useful in keeping insects in check. As our birds have been killed off, insects have increased. In an orchard that years ago was the home of numerous woodpeckers, the trees were comparatively free from insects owing to the work of these and other birds. Now, with fewer birds, the trees must constantly be sprayed.

Farmers have begrudged birds the little fruit or grain they have taken, not knowing the valuable service they rendered in keeping down insects. Even some writers call the robin a thief and a nuisance. Robins do take fruit, but they also eat many troublesome ground insects as do meadow larks. Swallows, fly-catchers and night-hawks live on flying insects. Orioles, warblers, vireos and cuckoos keep down the leaf-eating insects and nuthatches and titmice busy themselves on the trunks of trees hunting for insects.

The English sparrow is a nuisance at times, but when a moth is in sight, sparrows will pursue it until they catch it.

It is true that blackbirds and crows are useful, but they should not be allowed to devour a whole crop. Clouds of blackbirds often pass over, particularly in the autumn, but they have never injured the author's crops severely.

Chewing insects that devour the foliage of plants or trees or the petals of flowers, are, as a rule, kept in check by poison sprays. The potato bug is an example of the chewing insect. Arsenate of lead is one of the most generally used poisons.

The sucking insect, such as aphid or plant lice, suck the juices or sap by inserting their beak-like tube into the tissues of the tree and therefore are not affected by poisons deposited on the surface of the plants. The sucking insects are controlled by contact sprays, such as nicotine sulphate or kerosene emulsion that reaches them through their breathing pores. By carefully noticing the damage done to the plants, the kind of spray to use can be determined.

Plant diseases are generally controlled by spraying with Bordeaux mixture, in which copper is the controlling element, or by the use of lime sulphur solution.

Sometimes the spraying mixture may include Bordeaux for the control of disease, and to this is added arsenate of lead to poison the chewing insects and nicotine sulphate as a contact spray, the three mixed and applied for all three purposes.

Importance of Cleanliness.—Clean cultivation is important. All growing crops, whether vegetables, flowers or fruits, should be kept free from weeds. All trash about the place should be burned. Weeds and rubbish make good breeding places for insects and disease.

Vigorous Growth.—Crops that are grown in good soil, well fertilized and cultivated, offer the greatest resistance to attacks of insects and disease.

Banding is used to prevent the ascent of canker-worms, moths and gypsy-moth caterpillars. Tanglefoot is the material generally used. A formula for making one form of this is given under Apple Insects, see Gypsy Moth. This may be applied directly to the tree trunk, but will leave a mark. It is best applied as there recommended.

Spraying with poison is now generally used in place of banding.

Fumigation with hydrocyanic acid gas is used to keep insects under control in greenhouses. It is a deadly and dangerous poison and the greatest care is required in its use. Use only 98 to 100 per cent. pure potassium cyanide and a good grade of sulphuric acid. Use only the following proportions: 1 ounce potassium cyanide; 1 fluid ounce sulphuric acid; 3 fluid ounces of water. Use *only* an earthen dish.

Pour in the water first and then add the sulphuric acid.

Never pour water into sulphuric acid, it is dangerous. Put the required amount of cyanide in a thin paper bag. All being ready, the house closed completely and locked so no one may enter, leaving open for exit one door, drop the bag of cyanide into the liquid and quickly leave, locking the door so no one can enter. Post signs of danger to prevent any accident. Have the house as dry as possible, and the temperature near 60 degrees. Some plants are very tender, roses and delicate foliage plants and more or less cyanide may be required according to the contents of the house. Leave closed over night and air freely in the morning before remaining in the house.

Dormant nursery stock should be as dry as possible. A fumigating house is made especially for this purpose. The fumigating house is built of two thicknesses of matched boards and building paper, well over-lapped between. The doors and ventilators made to fit tightly.

The stock is left on the wagon or piled loosely to permit free circulation of the gas. One ounce of potassium cyanide is used for each 100 cubic feet of space, the fumigation continuing for an hour. Control of ventilators should be from the outside.

Fumigating Citrus Trees.—The trees are covered with tents made of 8 ounce army duck or 6½ ounce special drill. The quantity of cyanide to use depends on the size of the tent, using one ounce of cyanide for each 100 cubic feet of space.

INSECTICIDES

Arsenate of lead can be applied in a stronger mixture than other arsenical poisons, without injury to foliage and is therefore better to use against insects hard to poison than other forms. It is made in paste form and in powder and may be

used with Bordeaux or lime sulphur. It is used at varying strengths from 2 to 5 pounds to 50 gallons of water.

Bisulphid of carbon is a liquid which volatilizes at a low temperature and the vapor is destructive to animal life. Very inflammable—keep from flame. Poured into a hole which is immediately closed up is the manner of using it for root insects. The gas permeates the soil, if loose, in all directions.

Useful for weevils in beans and grain. A saucerful in the top of a barrel of seed, the top tightly covered, will penetrate the mass and destroy the weevils.

When used in bins the temperature should not be below 65 degrees, using 5 pounds for each 1,000 cubic feet. The bins should be made tight and the liquid sprinkled over the contents and the bins closed for twenty-four hours.

Carbolic Acid and Soap.—For use for borers. One ounce crude carbolic acid; 1 pound fish oil soap; 1 gallon hot water. Mix thoroughly. Apply with soft broom only on dormant trees.

Carbolic Acid Emulsion.—One pound soap; 1 gallon water; 1 pint 90 per cent. crude carbolic acid. Dissolve the soap in hot water; add the carbolic acid and agitate until it emulsifies. When used for root-maggots, dilute with 30 parts water.

Bordeaux Mixture was originally used as a fungicide, which it is; but it is frequently used as an insect repellent. It is recommended as a 5-5-50; 4-4-50 and a 3-3-50 formula. The first figure refers to the number of pounds of copper sulphate, the second the stone or lime and the third to the number of gallons of water. Bordeaux is used on some plants as weak as 2-2-50.

Dissolve the copper sulphate in 25 gallons of water in a wooden or earthen vessel. In a separate vessel slake the lime and add water to make 25 gallons. Pour the two solutions at the same time through a strainer into the tank.

It is convenient, where there is much spraying, to have stock solutions ready. The stock solution of copper sulphate is made by dissolving one pound to each gallon of water. Suspend the copper sulphate in a coarse sack at the top of a barrel or tank of water, so the material will be just submerged. Leave it until all has dissolved.

The lime solution is made by first slaking lime in water and then adding sufficient water so each gallon of water will contain one pound of lime. Stir thoroughly before using the stock solution and do not mix until ready to use. To make up a stock solution of a 2-2-50, 3-3-50 or 5-5-50, taking the first formula for example, making 50 gallons; simply take 2 gallons of the copper sulphate solution and pour into a container and add water to make 25 gallons. Then take 2 gallons of the lime solution and pour into a container and add water to make 25 gallons, then pour both solutions into the sprayer at the same time.

Commercial Bordeaux can be purchased and this is desirable where only small quantities are to be used.

Kerosene Emulsion.—One-half pound of soap, hard or soft; 1 gallon water, 2 gallons kerosene. Dissolve the soap in hot water, remove from fire and while still hot add the kerosene. Pump the liquid back into itself five minutes or more or until it becomes creamy. This is more thorough and easier than stirring vigorously. When properly made, it will be a perfect emulsion and the oil will not separate.

When used on foliage for plant lice dilute with 10 to 15 parts of water. On dormant trees dilute with 5 to 6 parts water.

The percentage of oil in the solution will be as follows: 10 per cent emulsion, add 17 gallons of water to 3 gallons stock emulsion; 15 per cent emulsion, add $10\frac{1}{3}$ gallons of water to 3 gallons stock emulsion; 20 per cent emulsion, add 7 gallons of water to 3 gallons stock emulsion; 25 per cent emulsion, add 5 gallons of water to 3 gallons of stock emulsion.

Oil Spray.—On the Pacific Coast oil averaging from 16° to 22° Baumé is used for the European pear scale and fruit lecanium and to destroy lichens. An emulsion is made of 5 lbs. fish oil soap; 1 lb. lye; 6 gals. petroleum and 43 gals. water.

Dissolve the soap in 10 to 15 gallons of boiling water and pour into the tank. Then the lye is added and the remainder of the water. The agitator is started and the mixture vigorously churned while the oil is poured very slowly into the tank. Agitate for a while before applying the spray.

Nicotine Oleate is prepared from free nicotine 40 per cent. (not nicotine sulphate) and red oil. It is both soapy and oily. Use $2\frac{1}{2}$ quarts of 40 per cent. free nicotine, mixed with $1\frac{3}{4}$ quarts of oleic acid or red oil which forms a soft soap. This is diluted with equal parts of rain water to form a stock solution. This will be sufficient for 500 gallons of spray solution for aphids, for which it is valuable, also for soft scale and greenhouse insects. Use 8 tablespoonsful of the stock to a gallon of water for aphids.

Lime sulphur is both a fungicide and insecticide. As made at home and commonly called home-made, is made as follows:

Twenty pounds quick lime; 15 pounds flowers of sulphur; 50 gallons water. The lime and sulphur must be thoroughly

boiled. A large iron kettle will be needed. The lime is first placed in the kettle and hot water is added gradually in sufficient quantity to produce the very rapid slaking of the lime. As soon as the lime begins to slake, add the sulphur and stir. Keep the mixture covered with burlap to keep up the heat. When slaking has stopped, add water and boil the mixture for an hour. An orange-red or dark green color will appear as the sulphur goes into solution.

After boiling, add the required amount of water and strain. The boiling can be done in a barrel where there is a steam boiler. A pipe or hose carrying the steam inserted in the barrel, running it down well toward the bottom, will cause boiling when the steam is applied through it. The boiling should continue until the sulphur is dissolved.

Lime sulphur is applied while the trees are dormant, for San Jose scale and also for peach leaf curl. Cover all the branches completely.

Home Made Concentrated Lime Sulphur.—This requires the same process as the preceding. The lime should be fresh lump lime, free from dirt, containing not less than 90 per cent magnesium oxide. Light or heavy flowers of sulphur may be used. Forty pounds lump lime, 90 per cent calcium oxide; 80 pounds sulphur; 50 gallons water. Stir vigorously while cooking. Add sufficient water to replace what is lost by evaporation, so when finished the material will make 50 gallons. If to be kept any considerable time, keep in tight containers and keep from freezing.

A hydrometer is a little glass instrument, somewhat resembling a thermometer for testing the density of liquids.

Concentrated lime sulphur should be diluted according to the following table according to its density, as indicated by a Baumé hydrometer.

Dilution of Concentrated Lime Sulphur

Degrees Baume	Specific Gravity	With each gallon of concentrate, use		Degrees Baume	Specific Gravity	With each gallon of concentrate, use	
		For San Jose Scale	For Blister Mite			For San Jose Scale	For Blister Mite
		Gallons of Water	Gallons of Water			Gallons of Water	Gallons of Water
35	1.3181	9	12	25	1.2083	5½	7½
34	1.3063	8½	11½	24	1.1983	5¼	7
33	1.2946	8	11	23	1.1885	4¾	6¾
32	1.2831	7¾	10½	22	1.1788	4½	6¼
31	1.2719	7½	10	21	1.1693	4¼	5¾
30	1.2608	7	9½	20	1.1600	4	5½
29	1.2500	6¾	9	19	1.1507	3⅔	5
28	1.2393	6½	8¾	18	1.1417	3½	4¾
27	1.2288	6	8¼	17	1.1328	3	4½
26	1.2184	5¾	7¾	16	1.1240	2⅔	4

Concentrated sulphur is now made commercially saving the trouble of making it at home. By using a hydrometer its strength may be determined and the proper dilution made according to the preceding table.

Miscible Oils.—There are a number of oil preparations now offered for San Jose scale. Oil solutions are more agreeable to use and corrode pumps less than lime sulphur. Different preparations require different dilutions, as stated on the directions. Oil solutions should be used when the trees are dry and the temperature above freezing.

Pyrethrum is also known as Persian insect powder. Not injurious to man in reasonable quantities. Should be fresh. Loses its properties with age and exposure. Can be used dry for lice on roses and other bushes. Apply in early morning

when the foliage is wet with dew. As a liquid spray use 1 ounce to 3 gallons of water and let stand 24 hours before using. Stir well before pouring into sprayer.

Soap.—Whale oil soap was one of the first insecticides used in this country. On the decline of whaling, other fish oils were found to be effective and are now offered as fish-oil soap. Use 1 pound to 6 gallons of water.

Soft soap and water is effective against plant lice.

The New York Experiment Station offers the following recipe as a good fish-oil soap, free from uncombined alkali: 6 pounds caustic soda; $1\frac{1}{2}$ gallons water; 22 pounds fish-oil.

Completely dissolve the caustic soda in water. Then very gradually add the fish oil, constantly stirring at the same time. Stir briskly for about twenty minutes after the last of the oil has been added.

Tanglefoot.—See Gypsy Moth under Apple Insects.

White hellebore is not as poisonous as arsenicals and is therefore used on ripening fruit or vegetables in place of them, to control leaf eating insects, such as the currant worm. Apply dry, or a little flour may be mixed with it to make it more adhesive. For liquid spray use 4 ounces to 2 gallons of water. Always be particular to see that fresh material is obtained when purchasing.

Rosin Fish-oil Soap.—Rosin is used as an adhesive to make the spray stick to the foliage. This process is spoken of as adding a sticker. Use 5 pounds pulverized rosin; 1 pound concentrated lye; 1 pint fish-oil; 5 gallons water.

The rosin and fish oil are placed in a kettle and one gallon of water added and heat applied to soften the rosin. Dissolve

the lye in a little hot water. When the rosin has softened in the kettle, very gradually add the lye mixture. Stir vigorously and gradually add the remaining four gallons of hot water. Boil for two hours or until the rosin soap will unite with cold water and not harden and separate. Add sufficient water to make up for what has been lost through evaporation and to bring the quantity of the mixture up to five gallons. In spraying, use 2 to 3 gallons to 50 gallons of spray material.

Stickers and Spreaders.—Spray solutions, quite like water, when sprayed on some foliage gathers in drops, leaving much of the surface unprotected. The aim of the operator is to cover all of the fruit and foliage. Soap is added to some mixtures and preparations of caseine. Calcium caseinate, to be had of dealers in spray material greatly improves the action of lime sulphur solutions, particularly when combined with arsenate of lead.

INJURIOUS INSECTS

Angleworm or Earthworm.—In gardens angleworms, so far as known, do no harm, in fact they are beneficial, their openings affording soil aeration. Darwin made a study of earthworms and found them very beneficial. They are not found in numbers, if at all, in poor soil.

On lawns and putting greens their casts are sometimes objectionable, nor are they welcome in the soil of pot plants. Lime water applied to the soil will bring them to the surface where they can be gathered and destroyed.

Ants.—Boiling water poured into the nests or kerosene oil poured into the nests will kill the colony. Kerosene also kills vegetation, but if used carefully on a lawn and not over too

wide a surface, the grass will soon grow again. Do not use kerosene near valuable trees or plants. A tablespoonful of bisulfid of carbon poured into holes and the holes immediately filled up will be effective. Where the ants are spread over a wide surface the holes should be not more than a foot apart and about six inches deep. Bisulfid of carbon is highly inflammable, so keep it away from flame.

Aphis or Plant Lice.—Nicotine sulphate, kerosene emulsion. In window gardens tobacco dust.

Bag Worm or Basket Worm.—Troublesome on evergreen and deciduous trees. In winter the bags may be seen hanging from the branches. Spray with arsenate of lead.

Blister Beetle.—Slim black or gray beetles, with long necks and soft shells. Feed on leaves of garden plants and trees. Spray with arsenate of lead.

Brown Tail Moth.—See under Apple Insects.

Cutworm.—Gray or brown worms feeding on the crown or roots of plants. Completely encircle the plant with heavy paper, sunk a little in the soil. Can usually be located by digging down in the soil near the plant. They will collect under pieces of boards placed near the plants. Clover soaked in Paris green water and scattered about the field is used by some.

A cut worm bait is made by mixing in the following proportions: 50 pounds of wheat bran; 2 pounds Paris green; 6 oranges or lemons. Mix thoroughly to consistency of thick dough by adding low grade molasses and water if necessary. Place in lumps near the plants over the field late in the afternoon. Another formula is 50 pounds of shorts; 1 pound Paris green, 1

gallon molasses; 1½ gallons water. Harrow in for cutworms that work below the surface.

Climbing Cutworms.—There are several species that climb vines and small trees at night and do damage. Use arsenicals and white hellebore. Tanglefoot.

Flea Beetles.—Tiny beetles that feed on various plants, particularly very young plants such as radish, turnip, cabbage and other vegetable and flowering plants. They jump when disturbed. Spraying with Bordeaux acts as a repellent.

Four striped plant bug is about a quarter of an inch long; bright yellow with black stripes. Punctures leaves and young shoots. Kerosene emulsion sprayed when the bugs are young is the remedy. Also jarring the bugs from the plants into a dish of kerosene oil. The tips of infested plants should be cut off and burned in the early spring to destroy the eggs.

Galls.—Nematode root gall is a disease causing knotting of the smaller roots of peaches, oranges and other plants. Most troublesome in the South and in the North on greenhouse plants.

In propagating be careful to use none but healthy stock. Plant disease-free plants in soil that is not infested. Use fertilizers having a high percentage of potash. In greenhouses disinfect the benches with crude carbolic acid, 90 per cent. strength, using two fluid ounces to one gallon of water. See that the soil for the benches has been frozen before it is used.

Gypsy Moth.—See Apple Insects.

May Bug, May Beetle and June Bug.—A large, hard shelled beetle. Feeds on leaves of trees. The larva is a white grub often found in sod land. Damages sod, strawberries and other plants. See White Grubs.

Mealy bug is a white, scale-like insect troublesome on greenhouse plants. Spraying with a hose in greenhouses may end them. Carbolic acid and soap or fish oil soap will be effective.

Nematode Root Gall.—See Galls.

Red Spider.—A very small mite most troublesome in greenhouses, particularly when dry. Spraying with water, wetting the underside of the foliage is the remedy. Dry sulphur is also effective. Liquid pyrethrum sprays are effective in field culture.

San Jose Scale.—See Apple Insects.

Scale.—See Apple Insects.

Snails.—Troublesome in greenhouses and outdoor gardens where young seedling plants are growing. In greenhouses they may be trapped by placing pieces of cabbage, tender lettuce leaves, or pieces of potatoes or turnip about. Lime dusted about the plants will keep them away.

Where a line of salt can be safely placed around the bed, it will keep them away. Covered with salt the snails will completely dissolve.

Wire worms are the larvae of the click beetle and feed on the roots of plants.

Plow infested land early in the autumn. Rotate crops. Baits poisoned with arsenicals, such as fresh clover placed about the bed under light boards.

White Grubs.—The larvae of the May bug. Sod land pastured to hogs between April and October will clear the fields. Especially injurious to corn, strawberries, potatoes and timothy. Autumn plowing when the grubs are near the surface and so sluggish they will not burrow, about the first to the middle of October in central New York will be helpful. Chickens or poultry when following the plow will destroy many.

Chapter XLV

INSECTS—VARIOUS TREES AND PLANTS

APPLE INSECTS

Aphis or plant lice are to be found on the foliage of various plants. Several species are common on apples, the apple bud aphis, rosy aphis, apple leaf aphis and wooly aphis. All the aphis are sucking insects and are controlled by contact sprays.

Lime sulphur applications when the eggs are hatching will destroy a large percentage and nitocine sulphate, one to five hundred, makes the spray more effective. Crude carbolic acid, 2 parts to 98 parts water, with 2 pounds of soap to each 50 gallons, is also used, as is kerosene emulsion.

The dormant spray for scale, when made late, destroys many of the aphis eggs. Nicotine sulphate added to the codling moth spray will keep the aphis under control, if they are troublesome at that time. The spray consists of lime sulphur arsenate of lead and nicotine sulphate. Dusting with tobacco dust and lime has also proved effective.

For wooly aphis a spraying of kerosene emulsion once or twice during the summer may be made if they become troublesome. Usually they are controlled by the other sprays given in clean orchards.

If wooly aphis troubles the tree roots a coating of tobacco dust or calcium cyanide may be used.

Apple Curculio.—White grub, half an inch long, lives in fruit. Clean cultivation. Rake the apples that fall, into sunlight which is fatal to the insect.

The plum curculio beetle sometimes feeds on the fruit and punctures it and lays its eggs. The larvae develop in the fruit and cause it to fall.

Spraying with arsenate of lead for the codling moth keeps the curculio under control.

Apple fruit miner is troublesome in Western Canada. The larvae bore into the fruit. Spraying with arsenicals is the remedy.

Apple-leaf skeletonizer, particularly troublesome in the Central States, is controlled by arsenicals.

Apple maggot is troublesome in the East. The maggot burrows in the fruit. Arsenate of lead is the remedy.

Borers.—The round headed apple tree borer attacks apples, pears and quinces, being most troublesome in the North and East. The sawdust-like material showing at the base of the tree in spring is the work of borers in making their entrance. They work on the roots, on the base of the tree and also on the trunk.

The borers are light yellow grubs, with a brown head. Eggs are laid by beetles in the bark of the trees, near the surface of the ground. The young larvae or grubs bore into the trees, living there and doing damage for three years, finally leaving as beetles to lay their eggs and raise a new crop of borers.

The trees should be carefully examined in the spring. May is the time in New York, removing all the borers found by means of a stiff wire, before they have been able to get far into

the wood. The trees should be carefully gone over again in the autumn. Only careful watching will keep this pest in check. The woodpecker is the apple growers' friend.

Mounding the trees with earth is sometimes practiced, which causes the eggs to be laid higher up where it is easier to get at them. The mounds are leveled in the autumn.

Tarred paper tied around the base of the trees is used by some orchardists to prevent egg laying on the trunks. Caustic potash and water with a pint of carbolic acid to each ten gallons painted on the tree trunks several times from May to July is also used. A wash may be used composed of common laundry soap 50 pounds, water 3 gallons, flake naphthaline 25 pounds, flour 2 pounds. Place the soap in warm water and allow it to stand and soften a few days. Then cook until the temperature reaches about 180 degrees F. Stir in the flour and add the naphthaline which will melt at that temperature. Then cool as quickly as possible so the naphthaline will form into fine crystals.

The mixture is applied to the trunk of the trees with a brush, while warm and thick. Make applications every three weeks beginning June first and continue until three applications have been made. When a tree is beyond recovery, cut and burn before May first.

Clean cultivation throughout the orchard and particularly around the base of the trees is necessary to keep borers down.

There are several species of borers including the round headed borer, the flat headed borer and the spotted apple tree borer. These may attack pear, peach, plum, cherry and other trees as well as apples. All are controlled in the same manner.

Brown-tail Moth.—Troublesome in New England. Snow-white moths, with brown hairs at the tip of the abdomen. The caterpillars are black, with brownish, stinging hairs, feed

on the tender foliage in spring. Spray with arsenate of lead as soon as the caterpillars hatch in the spring. Band trees with tanglefoot and keep the bands fresh by frequently recoating. See also Elm Insects.

Bud moth is a troublesome insect throughout the North, not only on apples but also on pears, peaches, cherries, plums and other fruits. The caterpillar is only about half an inch long, getting into the buds as soon as they open, feeding on the tender leaves and tying them together with fine threads, where it lives for several weeks. Arsenate of lead, 2 pounds to 50 gallons of water, applied as the leaf and blossom buds are opening, is the remedy.

Canker worm caterpillars arrive early in spring and unless checked will defoliate the trees. Spraying just before the blossoms open and again after the petals fall, with arsenicals, is the remedy.

Cigar-case bearer is troublesome on apples, plums and pears. It eats holes in the buds and young leaves, later making its case on the surface of the leaf. Arsenate of lead 2 pounds to 50 gallons of water is the remedy.

Codling Moth.—This insect is known wherever apples are grown. On the Pacific Coast there are three broods in a season; in Western-Central states there are one or two broods and in the Northeast but one.

In the Northeast the eggs are laid about two weeks after the petals of the flowers fall. In three or four weeks after the petals fall, the larvae leave the foliage on which they have been feeding and enter the fruit, usually at the calyx end. They sometimes enter the stem end, burrowing to the core and finally burrowing their way out of the fruit.

Arsenate of lead is the usual spray for the codling moth. This is applied when three-fourths of the petals have fallen and finished before the calyx cup is closed. Dusting is used in some orchards instead of a spray. A second spraying is given a week later to get the late hatched brood. The late hatched brood may enter the fruit from the side, if the calyx is closed.

Fall Webworm.—Hairy larvae about an inch long, feeding on leaves of various trees in tents or webs. Destroy by burning the webs. Spraying with arsenicals is also effective. The webs may be removed by hand and the larvae crushed. Burning will likely injure the tree.

Flea beetles are most troublesome to young trees. Arsenate of lead and Bordeaux combined is recommended.

Gipsy Moth.—Spray with arsenate of lead, 5 pounds to 50 gallons of water, as soon as the caterpillars hatch in the spring. Band the trees with tanglefoot when they are migrating. See also Elm Insects.

Tanglefoot can be made by boiling 7 pounds of castor oil, 9 pounds of rosin, $\frac{1}{2}$ pound of paraffin wax. This is a particular operation. Too much heat and it may catch fire and is almost impossible to extinguish, so look out for setting fire to buildings.

This may be applied directly to the tree trunk or to a band of heavy paper about 10 to 12 inches wide. The bark of the tree trunk is then smoothed and the band of tanglefoot tacked on. It will need replacing or recoating as the bodies of the dead insects tend to form a bridge over the band.

Green Apple Worm or Green Fruit Worm.—Several species of these worms attack apples, pears, peaches and plums, eating

holes in the sides of the fruit. The moths are small and the color is gray. Arsenate of lead added to the delayed dormant spray and also to the pink spray.

Leaf crumpler, a brown caterpillar. Are "chewers" and are controlled by arsenicals.

Leaf hopper is a sucking insect controlled by nicotine sprays. Troublesome on apple, currant, gooseberry, raspberry and other plants.

Leaf miners riddle the foliage. Spraying with nicotine sulphate and soap added is the remedy.

Leaf roller is another trouble maker, easily recognized by the rolling of the leaves, not only on apples but on other fruits. The eggs are laid on the bark and the remedy is spraying with miscible oil while the trees are dormant in the spring. Arsenate of lead, 2 pounds to 50 gallons of water, should be applied as the buds are breaking and again when the cluster buds begin to separate.

Oyster shell scale sometimes requires special attention, spraying in June with nicotine sulphate, 1 pint to 100 gallons of water, with 6 pounds of soap, or use kerosene emulsion. In the South where there are two generations a second spraying may be needed in August or September.

Pear-leaf blister mite are troublesome in the East on apples and pears. The leaves show reddish blisters which later turn brown, caused by colonies of small mites. The leaves yellow and drop, weakening the trees. Spraying with lime sulphur

when the buds are breaking or autumn spraying as soon as the leaves drop, with miscible oil.

Pistol-case bearer is controlled in the same manner as cigar-case bearer.

Ribbed cocoon maker is most troublesome in the eastern part of the continent from Canada to Texas. The foliage is skeletonized by the larvae. Arsenate of lead is the remedy, applied when the caterpillars are troublesome, usually in June. The dormant spray of oil or lime sulphur usually keeps them under control.

Rose Chafer.—See Grape Insects.

San Jose scale forms a crust on the branches and multiplies rapidly. Lime sulphur or miscible oil in the dormant season keeps scale under control. Where badly infested, spray in the autumn and again in the early spring. Other scale insects are controlled in the same manner. See Peach Insects.

Tent Caterpillar.—Treatment same as fall webworm.

The chewing insects are kept under control by the spraying done for the codling moth, if the work is thoroughly done.

Tussock moth, a caterpillar about an inch long, eats leaves and fruit. The frothy egg masses can be collected in autumn and winter. Spray with arsenicals, being sure to cover the under side of the foliage.

Aster Insects

Aster Worm.—A small insect boring in the stem of the plants usually as they are about to flower. Clean cultivation, burning all weeds, particularly cocklebur and ragweed, before September. All infested plants should be burned.

Aster Root Lice.—Water with weak tobacco water or use tobacco dust around the plants.

Blackberry Insects

See Raspberry.

Cherry Insects

Aphis or Lice.—See Apple Insects.

Canker Worm.—See Apple Insects.

Curculio.—See Plum Insects.

Rose Beetle.—See Grape Insects.

Slug.—Shiny, black larvae, feeding on leaves. Spray with arsenicals or hellebore.

Chrysanthemum Insects

Cabbage looper is sometimes troublesome to chrysanthemums. It is a pale green, striped worm a little more than an inch long which feeds on the leaves. Spray with kerosene emulsion or dust with pyrethrum mixed with double the quantity of flour.

Chrysanthemum Leaf Miner.—Spray once a week with nicotine sulphate, 1 part to 400 parts of water.

Cranberry Insects

Cranberry Girdler.—Small caterpillars that feed on the stems beneath the surface. To prevent, reflow after picking, for a week or ten days, or reflow for a day or two about the tenth of June.

False Army Worm.—Green or black caterpillars that eat leaves and buds. To prevent, reflow a little after the middle of May for twenty-four to thirty-six hours and reflow a second time if necessary. Destroy any caterpillars washed ashore.

Spray with arsenate of lead, early in May in dry bogs.

Cranberry Worm or Black-headed Cranberry Worm.—Green larvae with black heads that feed upon young shoots and leaves, drawing them together with fine threads. Use arsenicals and flood for two or three days when worms come down to pupate.

Yellow-headed Cranberry Worm.—Small, yellowish-green caterpillar with yellow head. Use arsenicals from middle of May to July. Hold water on bog late in spring to prevent egg laying.

Fruit Worm.—Small caterpillars that eat out the insides of fruit. In dry bogs, spray with arsenate of lead three times in July and bury all screenings.

Reflow for ten days as soon as through picking. When foliage ripens turn on water for the winter, drawing it off early in April. Every third year hold it until middle of May.

Currant Insects

Currant Borer.—A whitish larva boring in canes. Also troublesome on gooseberries. Remains in canes over winter. Cut off and burn affected canes in autumn and early spring.

Currant Worm.—Yellowish-green larva, a little more than half an inch long which eat the leaves. Generally troublesome wherever currants are grown. Spray early with arsenicals for the early brood while the larvae are working low down on the bushes. Thorough work at this time will end the trouble. If a second brood appears, use white hellebore, to prevent danger of poisoning of fruit, which would result if arsenicals were used.

Four Striped Plant Bug.—See Injurious Insects

Green Leaf-hopper.—A small insect which works on the under sides of the leaves of currants, gooseberries and apple trees. Spray with kerosene emulsion, nicotine sulphate or pyrethrum or dust with tobacco.

Measuring or Span Worm.—Larva about an inch long, with stripes and dotted with yellow and black. Feeds on the leaves. Arsenicals or white hellebore.

Stem Girdler.—Female is a wasp-like insect about half an inch long, with black body, which girdles the stems. The larva bores into the stems. In May or June, as soon as wilted tips are seen, cut them off two or three inches below the point of breaking and burn, to destroy the eggs.

Currant Fruit-fly.—Smaller than a housefly, pale yellow with dark bands across the wings. The maggots are white. They burrow in the fruit and cause it to drop. Spray with arsenate of lead, $2\frac{1}{2}$ pounds to 100 gallons of water, with 2 gallons of molasses added.

Elm Insects

Brown Tail Moth.—White moths with tuft of brown hairs at end of abdomen. The winter nests are easily seen on the trees and should be cut out and burned before spring.

Spraying before the middle of August with 4 pounds of arsenate of lead powder to 100 gallons of water will kill the caterpillars, which are an inch and a half long, reddish brown to almost black, with tufts of brownish poisonous hairs. See also Apple Insects.

Gipsy Moth.—All cavities in shade trees should be filled as suggested under Tree Surgery, to prevent moths from hiding eggs in them. The egg-masses should be treated with crude coal tar creosote and lamp black. The black will show where treatment has been applied.

It is a good plan to band the trees with eight-inch strips of burlap tied in the middle, around the tree. The upper half should be folded down over the lower part. The caterpillars will hide beneath these bands, where they may be caught and killed. Spray the trees while the caterpillars are small, with arsenate of lead, powder 3 pounds to 100 gallons of water. See also Apple Insects.

Canker Worm.—See Apple Insects.

Elm leaf-beetle, a small beetle troublesome in the East. Eats green matter from leaves. Spray with arsenate of lead 1½ pounds to 25 gallons water.

Elm Saw-fly Leaf Miner.—Greenish-white larva which feeds between the two layers of the leaf. Large blotches appear on the foliage which dies and falls. Where this insect appears the trees will soon be killed unless given attention. Spray with

nicotine sulphate, 1 gallon to 800 gallons of water, adding about 32 pounds of fish oil soap. Apply when the blotches are from $\frac{1}{3}$ to $\frac{1}{2}$ inch in diameter.

Willow Worm.—See Willow.

Gooseberry Insects

Currant Borer.—See Currant Insects.

Measuring or Span Worm.—See Currant Insects.

Four Striped Plant Bug.—See Currant Insects.

Currant Worm, also called Gooseberry Worm.—See Currant Insects.

Green Leaf-hopper.—See Currant Insects.

Gooseberry Fruit-worm.—Larva about three-quarters of an inch long, greenish with brownish head. Feeds on outside and inside of berries, sometimes webbing them together and tying the leaves into masses. Spray with arsenate of lead, $2\frac{1}{2}$ pounds to 100 gallons of Bordeaux as soon as the webs are noticed. In small gardens, hand pick infested berries and caterpillars.

Grape Insects

Grape Berry-worm or Berry Moth is widely distributed. The larvae of the first brood destroy the recently set berries. The second brood live within the growing berries. Clean cultivation, keeping grass and weeds away from the vines, spray with arsenate of lead combined with Bordeaux with a sticker of rosin fish oil soap added. Make the first application as soon as the blossoms fall and the second when the berries are just touching each other. Use $1\frac{1}{2}$ pounds of arsenate of lead and 1 pound of rosin fish oil soap to 50 gallons of Bordeaux.

Grape Curculio.—A small, brown beetle appearing in May or June, and after feeding, punctures the grape and lays an egg in it. In about a week the egg hatches a whitish larva with a brown head that feeds on the berry and seeds. The grub drops to the soil and makes a cocoon on or just below the surface and the beetles emerge in about three weeks. Spray thoroughly with $2\frac{1}{2}$ pounds of arsenate of lead powder to 100 gallons of water as soon as the beetles appear and give a second spraying if necessary.

Grape Root-worm is widely distributed. Beetle is reddish-brown, about $\frac{1}{4}$ inch long. The grub is white with a yellowish-brown head and is about $\frac{2}{5}$ inch long. The beetles eat chain-like holes in the leaves; the grubs feed on the smaller roots and rootlets and sometimes eat the bark on the larger roots. Late June and early July. Thoroughly cultivate in early June to kill the pupae which will be only two or three inches below the surface at that time. Spray foliage thoroughly with arsenate of lead, 3 pounds powder to 100 gallons of water as soon as the beetles are seen and give a second application in about ten days.

Grape-vine Flea Beetle is about $\frac{1}{5}$ inch long of a dark metallic blue color which feeds upon the buds and tender shoots early in the spring. The larvae are about $\frac{1}{3}$ inch long, yellowish brown, with rows of black spots. The larvae feed on the foliage. Spray with 3 pounds of arsenate of lead, 1 gallon of molasses, 100 gallons of water, used as the buds are swelling, for the adults. For the grubs spray the foliage with Bordeaux adding 3 pounds of arsenate of lead to each 100 gallons.

Grape-vine Sphinx.—Fully grown specimens are nearly 2 inches long, green, with yellow stripes and spots. Feed on leaves and cause the young grape clusters to drop. These and other caterpillars are controlled by the use of arsenicals and hand picking, dropping them into a can, partially filled with kerosene.

Phylloxera is a minute insect. The lice damage the roots of the European types but the American types of grapes are not often affected to any extent. Flooding the vineyards for one to three weeks is the only remedy that has been successful.

Leaf Hopper works on the under side of the leaves, causing them to turn yellow and fall before the grapes ripen, thus checking the growth of new wood. Keep the vineyard clean of grass and weeds. Spray with nicotine sulphate 1 gallon to 1000 gallons of water or of the same quantity of Bordeaux; 2 pounds of fish oil soap to each 50 gallons of water will make it spread and stick better. Wet the under side of all leaves thoroughly.

Rose Chafer sometimes feed on the blossoms and on the young fruit and foliage. At the first appearance of the beetles spray with arsenate of lead, 3 pounds to 100 gallons of water, with 2 gallons of molasses added. Repeat in a week.

Hollyhock Bug.—A small green bug which sometimes is troublesome on hollyhocks. Spray with kerosene emulsion or nicotine extract.

Orange and Lemon Insects

Mealy bug is common in greenhouses and is a serious trouble in California and Florida. Controlled by spraying with water under high pressure, frequently applied.

Argentine ant must be eliminated in California. Poison bait is used consisting of 12 pounds granulated sugar; 7 grains crystallized tartaric acid; $\frac{3}{4}$ ounce sodium arsenite; 2 pounds strained honey; 9 grains benzoate of soda and 11 pints water, has been suggested by the State Experiment Stations and U. S. Department of Agriculture. The method is to place 10 pints of water over a slow fire. When tepid add tartaric acid, then benzoate of soda, following with the sugar, added slowly, while stirring to prevent burning.

Measure the depth of the liquid with a stick. Bring to a boil slowly and allow to simmer for thirty to forty minutes. Remove from stove and add water to make up for that lost from evaporation. Stir the honey in before the mixture cools. Then add the sodium arsenite which has been dissolved in 1 pint of hot water and partially cooled before pouring into the syrup, stirring thoroughly.

Dip a four ounce spice box in paraffin to make water tight and prevent rusting.

In filling the can leave sufficient room for a half an inch of syrup which is poured on top, and then fold in a few strands of excelsior. Punch a small hole in the side near the top, so the can may be hung on a finishing nail driven into the tree. Put on the top and hang on the nail. The nail having no head permits the ants to enter the box through the hole on which it is hung.

Black Scale.—Troublesome in California but not now serious in Florida. Injurious to orange, lemon, apricot, prune and olive. A sooty mold grows in the excretion which the insects cause, which damages the leaves, interfering with the proper development of tree and fruit, necessitating washing the fruit before it can be marketed. Fumigation with hydrocyanic gas is the remedy, also kerosene emulsion made with 15 gallons of a low grade kerosene known as water white oil; 4 pounds hard soap shaved fine; water 200 gallons. Pour 10 to 15 gallons of water into the tank with the soap, start the agitator and run for a few minutes, then add the oil slowly with agitator in motion. Pump the material back into itself until an emulsion is effected and then add 200 gallons of water.

The mixture must not be allowed to run down the tree trunks and collect at the base of the trees or injury will result.

Citricola Scale.—Dull gray with yellow spots. Fumigation with hydrocyanic gas is the method of control.

Purple scale is troublesome on orange, lemon, grapefruit and other plants. It is brownish purple. The control has been by fumigation with hydrocyanic gas. Lubricating oil emulsions are now being used. Two sprayings are given in summer, one month apart and two in winter six weeks apart.

Bordeaux oil emulsion serves two objects, cure for insects and disease. This is a mixture of Bordeaux and oil emulsion and is made as follows: soft water 1 gallon; potash fish oil soap 1 gallon, or 8 pounds; paraffin oil 24° or 28° Baume. The soap is first placed in the container and the oil added a little at a time and stirred vigorously into the soap. When all the oil is stirred in well, the water is poured in very slowly, only a little at a time and stirred in in the same manner. When free oil appears on the surface add more soap and stir until no more oil is seen.

Red scale in California is found on plum, pear, apple, quince, orange, lemon, olive, fig and other plants. Control is by fumigation with hydrocyanic gas.

Yellow Scale.—Lighter in color than the red scale and is controlled in the same manner.

Red mite is distributed from New England to Florida and west to the Pacific Coast. It is also found in Canada, attacking citrus fruits, apple, peach, prune, pear, cherry and others. Sucks the plant juices, causing the foliage and fruit to drop, causing loss of crop and weakened condition of tree. The remedy is lime sulphur solution testing 36° Baume, 2 gallons to 100 gallons of water. Lime sulphur testing less will require less reduction with water. Apply when the temperature is below 100° F.

Rust mite causes rust on oranges and lemons. Control is the same as for red mite.

Red Spider.—Greenish yellow, working on under side of leaves. Also troublesome on plum and prune. Controlled in same manner as red mite.

Thrips.—A very small yellow insect that scars the fruit and curls the leaves. To control, make four applications of lime sulphur 36° Baume, 1 gallon in 75 gallons of water with nicotine sulphate 1 part to 1,800 parts of the diluted lime sulphur. The first application should be given just after the petals have fallen from the blossoms. The second, two weeks later. The third three weeks after the second application, and the fourth in August or September.

White Fly.—Minute insect with four wings. The nymph looks like scale as it is found on under sides of leaves. To control, spray with oil emulsion, using the formula recommended under oil emulsion under Purple Scale, at a one per cent strength by adding water to the stock solution to make two hundred gallons. Make the first application in April or May when the oranges are about an inch in diameter. Make the second application late in August or early in September, in the southern citrus section or the last half of September in the northern section.

Winter fumigation with hydrocyanic gas has been used somewhat in Florida.

Peach Insects

Black Aphis or Louse.—Attack tops and roots of peach trees. Carefully examine all trees as soon as received from nurseries. If there are lice on the roots return them immediately or burn. If they must be kept, remove the soil carefully from the roots and dip in nicotine sulphate, $\frac{1}{4}$ pint in 25 gallons of water. If orchard trees are infested, remove the earth to the depth of a few inches and put in tobacco dust and replace the earth. Give good cultivation and fertilization. Lice on the foliage are controlled by spraying with nicotine sulphate, 1 pint to 100 gallons of water to which 5 pounds of soap has been added.

Green Peach Aphis or Louse.—Common on many plants. Cause leaves to curl and die. Spray just before the buds open, but after the eggs have hatched, with nicotine sulphate, $\frac{3}{4}$ pint to 100 gallons of water, adding 5 pounds soap.

Flat Headed Apple Tree Borer.—See Apple Insects.

Round Headed Apple Tree Borer.—See Apple Insects.

Peach Tree Borer.—Generally distributed throughout the United States and Canada where peaches are grown. The larva a small moth. The borer is pinkish-white, with a dark reddish brown head, and is nearly an inch long. The borer burrows partly in the inner bark and partly in the sapwood, generally just below the surface of the soil. Gum exudes from the wounds around the base of the tree. Young trees may be killed and old ones practically ruined.

Cut the borers out in the autumn, or in the spring before the first of June, or better at both these seasons. After treating mound up the tree 6 inches high, causing the borers to enter the tree higher up where it is easier to get at them.

For trees more than three years old, crystals of para-dichlorobenzene may be applied in a ring about the base of the tree. The soil should be scraped away around the trunk, and an ounce of the crystals spread in a ring around the tree, two inches from the bark. Replace the soil and leave for six weeks. For trees less than six years and more than three years old, not more than $\frac{3}{4}$ ounce of the crystals should be used to each tree. Young trees not more than three years old may be injured with this treatment. This remedy, in New York, is applied the first week in September.

Peach Twig Borer.—The larva of a moth; about $\frac{1}{4}$ inch long. Burrows in the tender shoots in the spring. The second brood bores in twigs and fruit and the third brood in the fruit. Spray with lime sulphur 1 gallon to 10 gallons of water, with 3 pounds of arsenate of lead powder. Apply at the pink stage of blossom. Good results have been obtained with $2\frac{1}{2}$ pounds of arsenate of lead powder to 100 gallons of water applied in the spring as the buds are beginning to open.

Lesser Peach Tree Borer is troublesome not only on peach trees, but also on plums and cherries. The larva is about $\frac{3}{4}$ inch long with a yellowish brown head. It feeds on all parts of the trunk and branches. Good cultivation and fertilization is about all that can be done, and carefully watching the trees and cutting out the borers, covering the wounds with tar. Badly infested branches and trees should be cut out and burned.

California Peach Tree Borer is troublesome in California and some of the Western States. It attacks peach, apricot, apple, cherry, plums and almonds. To control, dig the borers out during winter or early spring. After digging out the borers, give the trees a coating of lime-crude-oil wash, which is made as follows: Put 50 pounds of rock lime in a barrel and slake with 10 to 15 gallons of warm water. While the lime is boiling, slowly pour in 6 or 8 gallons of heavy crude oil and stir thoroughly. Add sufficient water to make the whole a heavy paste. Apply immediately with a heavy brush.

San Jose Scale.—Troublesome wherever peaches and apples are grown in United States and Canada.

Lime sulphur, dilutions of 1 gallon to 8 gallons of water when it tests 32° to 33° Baume, applied late in spring before the buds open, is used on peach, apple, plum and other fruits. On apple trees having rough bark, oil emulsion applied in the dormant season is usually more effective.

West Indian Peach Scale.—On badly infested trees the scale gives the trees a whitish appearance. Unless controlled, branches are killed and eventually the whole tree. The lime sulphur spray used for San Jose scale keeps this disease under control.

Terrapin Scale is reddish brown to blackish, common everywhere and attacks many different plants. Miscible oils applied late in the spring, between the swelling and opening of the buds.

Oriental Peach Moth is troublesome in the Eastern States, on peach, plum, cherry, apple and quince trees. It is a small grayish-brown moth. The larva is pinkish-white with a brown head and is about $\frac{1}{2}$ inch long. It bores into the tender young shoots and destroys the terminal buds. Later burrows into more mature twigs. Also burrow through the fruits, which causes decay.

Winter applications of lime sulphur have been found helpful. Arsenate of lead, 4 pounds of paste or 2 pounds of powder to 100 gallons of water has aided. Make the first spraying at the dropping of the bloom and the second application a month later.

Arsenate of lead on peaches is apt to be injurious. Add 2 to 3 pounds of fresh stone lime to each 50 gallons.

The Virginia Experiment Station recommends planting early season and mid-season ripening peaches, as they may be protected by spraying from petal drop to picking by spraying. Add nicotine sulphate 1 to 800 dilution to the summer sprays. Give clean cultivation and promptly burn all wood pruned out.

This pest, while it is a biting insect, sets aside the first few mouthfuls of food and consequently does not get all the lead arsenate. Often it cannot be told that there is a worm in the peach, until it is broken apart. Peaches with worms will ripen and decay in shipment or storage. The loss to shippers has been heavy on this account.

Peach Tree or Fruit Tree Bark Beetle.—A dark brown beetle about $\frac{1}{10}$ inch long. The larva is white with yellowish

head about $\frac{1}{5}$ inch long, burrowing under the bark. The beetles sometimes bore into the base of the buds and destroy them. The beetles appear in March, April and May, boring into the bark and along the branches in the bark and sapwood in which the eggs are deposited.

All brush and dead and dying branches and dead and dying trees should be removed and burned. Wild fruits growing near the orchard should be disposed of in the same manner. Orchard trees should have proper, general care, good cultivation and fertilization. Apply a thick whitewash to the trunk and branches three times during the season, in early spring, late March; in midsummer, the second week in July and again in the autumn, the first week in October.

Plum Curculio.—Not only is the fruit injured by adults and larvae, but brown rot is spread by the beetles and their punctures encourage rot.

Formerly the remedy was spraying with arsenate of lead, 4 pounds to 100 gallons of self-boiled lime sulphur. First when the husks drop from the fruit; second two weeks later; Two applications is all it is safe to give.

In Georgia arsenate of lead is used and is made safe for peaches by adding milk of lime or lime in combination with some material to the arsenate solution applied as follows:

First application: One pound of powdered arsenate of lead; Lime water made from 3 pounds of good stone lime to each 50 gallons of water. Applied after the petals fall. A second application of the same solution is made about ten days later when the calyces are shedding.

Two weeks later a third application is made, 1 pound of powdered arsenate of lead is used with each 50 gallons of an 8-8-50 self-boiled lime sulphur. That is 8 pounds copper sulphate, 8 pounds fresh stone lime and 50 gallons of water.

About four weeks before the fruit is to ripen use the same spray as used the third time.

A second generation occurs in Georgia and the trees are dusted with 10 pounds of arsenate of lead and 90 pounds of hydrated lime dust, four weeks after the harvest, and a second application two weeks later.

Brown Mite, commonly known as clover mite and almond mite, feeding on alfalfa and other clovers, grasses and on peach, cherry, plum, prune, quince, apple, apricot, pear and citrus trees. They are only about as big as the head of a small pin. The foliage becomes covered with black specks, the droppings of the insects. The leaves finally turn yellow and drop. Oil emulsion or lime sulphur is used from December to February in California, for the winter eggs.

Lime sulphur should be used at winter strength during the dormant season and as late in the spring as possible to kill the young mites. Dusting is also effective, using 90 pounds of dry sulphur and 10 pounds of lime.

Tarnished Plant Bug is troublesome on many fruit and vegetable and flowering plants, peach, apple, pear, plum, strawberry, dahlias, asters, chrysanthemums, potatoes, etc.

The adults and nymphs puncture buds and leaves and suck the juices. The leaves curl up and the blossoms are injured and the terminal buds of young trees are damaged. Sometimes the peaches are punctured. Flowering plants and vegetables may be protected by dusting with two per cent nicotine dust. Clean culture in the orchard is the only remedy now offered.

Peach Tree Bark Beetle is troublesome in the northeastern part of the country and in Canada on peaches and cherries and in the Middle Northern States, somewhat resembling the fruit-tree bark beetle and the control is the same.

Pear Insects

Borer.—See Apple-tree Borer.

Bud Moth.—See Apple Insects.

Codling Moth.—See Apple Insects.

Pear Psyllia.—Dark reddish-brown about $\frac{1}{10}$ inch long, with four transparent wings. The young cover the fruit with a sooty fungus. There may be four broods annually. Spray the trees with lime sulphur solution, 1 gallon to 8 gallons of water during late April or early May as the cluster buds are opening to destroy the eggs and nymphs. In the late summer destroy the nymphs with nicotine sulphate $\frac{3}{4}$ pint; soap shavings 5 pounds and 100 gallons of water. The soap may be omitted and 25 pounds of hydrated lime added and 2 pounds of copper sulphate, for scab. Good results are also obtained from summer spraying with $2\frac{1}{2}$ gallons of lime sulphur; hydrated lime 40 pounds; 1 pint nicotine sulphate and 100 gallons of water.

Pear Thrips attack pears, peaches, apricots, cherries, prunes and almonds. Tiny insects that attack buds and blossoms and prevent fruit from setting. The eggs are deposited in the stems of the fruit which cause it to drop.

In California thorough plowing and cultivation are recommended. From October to December the soil should be deeply plowed, harrowed, cross-plowed and again harrowed. In New York spraying with nicotine sulphate, 1 pint; miscible oil 5 gallons and 95 gallons of soft water. The first application is given as the buds are opening at the tips and the second two or three days after the first. A third application with lime sulphur or Bordeaux with $\frac{3}{4}$ pint of nicotine sulphate to 100 gallons, as the cluster buds separate.

Pear Slug attacks pear, plum and cherry. It is the larva of a glossy black sawfly. The larvae are blunt and tapering, green and slimy, changing to yellow. Spray with arsenate of lead, $2\frac{1}{2}$ pounds of powder to 100 gallons of water. Arsenate of lead should not be used on cherries when the fruit is about to ripen. After the fruit has been picked, spray in August for the second brood.

Pear Leaf Blister Mite burrows in the leaves, resulting in galls and causing the leaves to drop. Spraying for San Jose scale with lime sulphur keeps the mites in check. In the autumn when the wood has matured or in the spring before the buds open, spray with lime sulphur, 1 gallon to 12 gallons of water.

False Tarnished Plant Bug is about $\frac{1}{4}$ inch long, dark brown or pale yellow, varying in color. The nymphs are green, and operate on the fruit and so do the adults. After the petals fall, spray with nicotine sulphate, $\frac{3}{4}$ pint with 4 pounds soap to 100 gallons of water.

When soap is recommended it must be thoroughly dissolved.

Green Fruit Worm.—See Apple Insects.

Midge.—A mosquito-like fly that lays eggs in the flower buds, which develop into grubs which damage the fruit. Collect and destroy infested fruit before the middle of May. Cultivate and plow in late summer to destroy the pupae which is then in the soil. On sandy soil, half a ton to a ton of kainit under the trees is said to have given good results. On heavy land repeated disking under the trees in June and July is recommended to destroy the larvae.

Sinuate Pear Borer is troublesome in New Jersey and New York and will very likely spread. The adult is a long, bronze beetle and the larva is a white grub which bores into the sapwood. The beetles feed on the foliage and arsenate of lead, 3 pounds to 100 gallons of water, applied late in May, will check them. The borers should be cut out. Use repellent washes as suggested for round headed apple tree borer.

Pecan Insects

Bud Moth.—A brown caterpillar feeding on the buds as they open and later on under side of leaves. Lime sulphur in dormant season, just before buds open and arsenate of lead in summer to kill the second brood.

Case Bearer.—A small caterpillar that attacks the open buds. Arsenate of lead as soon as the buds open.

Borers.—Caterpillars that work in the sapwood. Must be dug out.

Round Head Borers.—See Apple Insects.

Rose Beetle.—See under Grape.

Twig Girdler.—Small beetle that girdles the twigs in August and September, the twigs soon fall, but not until the eggs have been laid above the girdle. Cut off the twigs and gather those that have fallen and burn.

Persimmon

White Peach Scale.—Lime sulphur when the trees are dormant.

Twig Girdlers.—Pick up and burn all fallen twigs.

Plum Insects

Plum Curculio.—Clean culture without weedy fence rows, hedgerows, stone walls and the like. Sunlight on the fruit that falls will kill the larvae. Prune to let sunlight into the trees. Cultivate in late July and early August to destroy the pupae in the soil. Spray with arsenate of lead, 2 pounds to 100 gallons of water, just after the petals fall and again ten days later.

The old method was jarring the beetles on sheets very early in the morning, beginning when the trees are in flower and continuing for six weeks. Special sheets or curculio catchers are made and sold for this purpose.

Flat Headed Borer.—See Apple Insects.

Pear Twig Beetle.—See Pear Insects.

Plum Gouger is a reddish brown beetle, with a prominent snout, varying in size, that eats cavities in the fruit. The female makes egg cavities in the fruit. Catch the beetles with a curculio catcher. Spray with arsenate of lead, making the first application as soon as the blossoms open.

Scale.—Spray with kerosene emulsion in dormant season.

Twig Pruner.—See Apple Insects.

Plum Aphis.—Several species may be troublesome on plums. Nicotine sulphate, $\frac{3}{4}$ pint to 100 gallons of water, with 4 pounds of soap, sprayings to be made before the leaves curl, so the insects may be reached with the spray.

Red Mite.—Trouble from this source is increasing on plum, prune, peach and apple. There may be six broods in a season.

The control is with miscible oils, 1 gallon to 15 gallons of water, applied before the buds start in spring.

European Fruit Lecanium (scale) attacks plum, peach, apricots, pear and currant and possibly other plants. The females are brown, hemispherical in form. The male is longer and smaller and glossy white. The control is spraying with kerosene emulsion 12 to 15 per cent emulsion in March or early April, or with miscible oil, 1 gallon to 15 gallons of water. In July the young scales may be killed with 1 pint of nicotine sulphate to 100 gallons of water and 5 pounds of soap.

Poplar

Poplar Borer.—The practice in nurseries is to spray with arsenate of lead to kill the parent beetles.

Willow Worm.—See Willow.

Cottonwood Leaf Beetle.—Feeds on poplars and willows. Spray with arsenicals.

Quince Insects

The quince is comparatively free from insect attacks. San Jose scale may appear at times; the round headed borer and codling moth are somewhat troublesome in some localities. Control measures for these will be found under Apples.

Quince Curculio.—The grubs leave the fruit in the autumn and enter the soil where they live over winter, transforming and appearing as adults from May to July the next year. Jar them from the tree into curculio catchers as soon as they appear and kill them by dropping the catch into kerosene oil. Spray with arsenate of lead, 3 pounds of powder to 100 gallons of lime sulphur or Bordeaux, applied as soon as the beetles begin to feed and again ten days later. Collect and destroy all the fruit that drops before the larvae leave them.

The bud moth is troublesome in some localities, also the leaf roller, which see under Apples. The pear slug is described under Pear.

Raspberry and Blackberry Insects

The raspberry, blackberry and dewberry are attacked by the same insects. Borers are usually the most troublesome.

Cane Borer.—A small, slender, black beetle that girdles the tips of the tender canes, causing the tips to wilt and fall over. An egg is laid above the lower girdle and the larva bores down in the cane and kills it. Cut off the tip as soon as it wilts, a few inches below the girdle and burn it.

Raspberry Fruit Worm.—The adult is a little brown beetle about $\frac{1}{8}$ inch long. The larva is white and about $\frac{1}{4}$ inch long. The beetles destroy the flower buds and injure the leaves.

The larvae live in and feed on the berries. Spray with arsenate of lead, $2\frac{1}{2}$ pounds to 100 gallons of water from the time the beetles appear until the buds open, keeping the foliage well covered. Poison on fruit flowers will kill the trees and therefore should be avoided. Cultivate shallowly from late summer to early autumn to destroy the pupae in the soil.

Raspberry Sawfly.—The larva is green and about an inch long, feeding on the leaves, new growth, buds and fruit, and the leaves are injured by the females depositing their eggs in them. Spray with arsenate of lead, $2\frac{1}{2}$ pounds to 100 gallons of water, as soon as the larvae are seen. Hellebore may be used before fruiting.

Where there are only a few plants the larvae may be brushed from the plants to the ground and if there are no weeds or grass under the plants, they will die.

Raspberry Root Borer.—Also called the blackberry crown borer. The moths appear in July or August and lay brown eggs on the under side of the leaves. The larvae crawl down the canes and bore into the stems below ground where they hibernate. In the spring they burrow into the canes and roots. The following season they burrow up in the base of the canes. Destroy all wild raspberry and blackberry bushes in the vicinity. The only remedy is to dig them out and destroy them.

Red-necked Cane Borer.—The adult is a slim, black beetle feeding on the leaves. The larva is white, about $\frac{1}{2}$ inch long, boring upward spirally, weakening the cane so the fruit does not develop. Cut out all infested canes in the autumn or early spring. Immediately the beetles appear, spray with arsenate of lead, $2\frac{1}{2}$ pounds to 100 gallons of water. Do not use poison when the berries are about to ripen.

Root Gall Fly.—Small larva causing galls on the roots of raspberry, blackberry and roses, killing the plants. The only remedy is to destroy the galls. Badly injured plants should be dug and burned.

Tree Cricket.—The female punctures the canes, making a scar about 2 inches long, in August and September. Cut and burn infested canes in early spring or late autumn.

Rose Insects

Rose Chafer, also called Rose Bug and Rose Beetle. Appear in swarms and eat the flowers. Spraying on grapes has been successful, but not on other plants. The beetles fly and when plants are sprayed with poisons the beetles fly away to feed on plants that are free from poisons. Arsenate of lead on roses will act as a preventative. Nicotine sulphate mixed with it will make it more objectionable. When the spray is worked off by dew and rain the beetles return. The author uses a spray called Sulco—V. B. A good repellant and it does not discolor the foliage.

Hand picking when there are only a few plants will afford some relief. See Rose chafer under Grape Insects.

Aphis or Plant Lice are troublesome on roses. Spray with nicotine sulphate.

Scale.—Scale insects, if troublesome, are controlled by spraying with kerosene emulsion.

Rose Midge is most troublesome on hybrid tea roses. The eggs are deposited under the sepals of the flower buds or between the leaves of the leaf buds. The maggots fall to the ground and remain over winter in the soil.

The last of October or early in November the soil in the rose benches in the greenhouse should be completely covered with tobacco dust about $\frac{1}{2}$ inch deep, to kill the maggots as they fall from the roses. Also fumigate the house with nicotine every night for two weeks and then every other night for a week, to kill the flies as they come out of the soil and before they deposit their eggs. If there are walks of earth in the house, spray them with kerosene emulsion.

Mealy Bug.—Nicotine sulphate. Spray early in the day and two hours later sprinkle with clean water.

Rose Leaf Hopper.—Lives on rose leaves and resembles thrips. Spray with fish oil soap, kerosene emulsion or nicotine sulphate. Dry pyrethrum powder blown on the bushes when the leaves are wet is also effective.

Strawberry Insects

Strawberry Weevil.—Small beetle about $\frac{1}{8}$ inch long; reddish black. The flower buds containing stamens are punctured by the females. Grow pistillate varieties, with every fifth row grow a staminate variety to properly pollenize the flowers of the other varieties. Give clean culture. Destroy all wild raspberry, blackberry, dewberry and strawberry plants. Dust the plants with arsenate of lead 1 part and hydrated lime 4 parts, well mixed. Finely ground sulphur 5 parts and arsenate of lead 1 part, is also recommended. Apply as soon as the weevils begin to be troublesome and give a second application a week later.

Strawberry Root Weevil.—A reddish brown beetle about $\frac{1}{4}$ inch long, turning black with age. They eat the roots and sometimes bore through the crown and feed on the foliage. Rotate crops. Thoroughly prepare and fertilize the soil the year before planting. Plants in old, unproductive beds should be plowed up and burned.

Leaf Roller.—Spray with arsenate of lead, 3 pounds to 100 gallons of water, applied as soon as the plants blossom. Give a second application two weeks later and additional applications as needed.

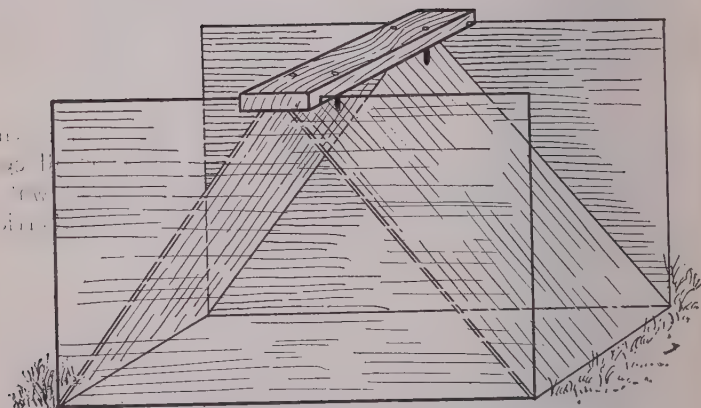
Root Louse.—Use only absolutely clean plants in setting new beds. Infested plants should be dipped, after all eggs hatch, in nicotine sulphate, $\frac{1}{4}$ pint to 25 gallons of water. Make new beds only on land not recently in strawberries. Old beds should be plowed under before May.

White grubs are the larvae of May beetles. See under Injurious Insects. They are one of the most troublesome of strawberry pests, eating the roots of the plants. Especially troublesome on beds made on recently turned sod land. Strawberry beds should not stand too long, follow them with some garden crop, beets, turnips or some other summer crop.

Saw Fly.—Greenish larva, $\frac{3}{4}$ inch long, feeding on leaves. Hellebore with arsenicals for the second brood.

Willow Insects

Willow Worm.—Larva about 2 inches long. Feeds on leaves of willow, poplar and elm. Spray with arsenicals.



GLASS PLANT PROTECTORS

*Chapter XLVI***DISEASES OF PLANTS**

Only a few of the more important plant diseases—those most generally met with—can be given in a work of this kind.

Diseases are more easily prevented than cured. Healthy plants in congenial soil, with proper fertilization and cultivation, like healthy persons, best resist disease attacks. Do not use diseased stock. Infested plants should be returned promptly to the dealer. To plant diseased plants or those infested with insects is only inviting trouble.

Almond

Almond Blight.—See Peach Blight.

Yellows.—See Peach.

Apple

Blight.—Fire Blight affects various fruits, apple, pear, plum, quince, apricot, etc. Remove the affected twig and wash the cut surface with cyanide of mercury 1 part, corrosive sublimate 1 part and glycerine and water 500 parts. Immediately wash the tool with the same solution. Make the cut a foot below the diseased area. Look the trees over carefully in winter and cut out any affected branches. See Pear.

Bitter Rot.—A discoloration beneath the skin, soon causing rot. The fruit may hang and long be a source of infection. Most troublesome in warm, damp seasons. Attacks nearly mature fruit and the limbs.

Cut out all cankers early in spring and remove all mummied apples remaining on the trees. Spray with Bordeaux 4-4-50, before the buds open, again after the fruit has set, following with one or two additional applications.

Scab, also called Black Spot. First appears as a rule on the under sides of the leaves in the form of a brown spot which later turns black. May also attack the blossoms and later the fruit. Appears in the spring and later during wet seasons. The fungus winters on the fallen leaves and the spores are distributed from the infected leaves.

Rake up and burn fallen leaves. Spray with Bordeaux 4-4-50 or lime sulphur just before the blossoms open, again when the petals fall and again a week or two later, if the weather is favorable for scab. Later spraying may be required if scab conditions are favorable. If possible spray before a rain. Rain spreads the disease and it is desirable to have the fruit covered before rains.

Black Rot Canker.—Affects ripe fruit causing it to rot. Also attacks the leaves, appearing as a purplish speck, later changing to yellow. Winters in the cankers. Spray with Bordeaux when the disease appears, in July and two weeks later.

Apple Blotch.—Most troublesome in Mississippi Valley. Attacks fruit, leaves and twigs. Small brown specks appear on the fruit when about six weeks old. They spread and the skin cracks and circular spots are formed on the leaves. Cankers are formed on small twigs.

Trees sprayed for bitter rot and scab will control blotch. Otherwise the remedy is Bordeaux 3-4-50 three weeks after the blossoms fall, with another application two weeks later and a third if needed. Blotch is most troublesome on Ben Davis, Limbertwig and Missouri.

Sooty Blotch and Fly Speck is most troublesome on light colored apples and on pears. It appears in a mass or cloud (sooty blotch) or in specks (fly-speck). Bordeaux or lime sulphur spray, as for scab, continued through July and August, is the remedy.

Brown Rot affects both pome and stone fruits. Trees sprayed for scab will be protected from brown rot.

Cedar Rust.—Entomologists claim that if there are no cedars within two miles there will be no cedar rust. Lime sulphur used at the delayed dormant spray, at the pink spray, calyx spray, second codling moth spray, has given satisfactory results in some orchards.

Powdery Mildew.—Attacks nursery stock, apple, plum, quince, etc., covering the leaves with a grayish white, powdery mildew, causing them to fall. Spray with lime sulphur, 1 gallon to 50 gallons of water, adding 3 pounds iron sulphate.

European canker attacks apple, pear, cherry, quince, etc. Treat as for black rot canker.

Northwestern Anthracnose, known also as Pacific Coast canker and black canker. Causes dark sunken areas in the bark. Young branches are chiefly affected late in the autumn, further developing in the winter. Also attacks fruit and causes

rotting. After the crop is picked, spray with Bordeaux 6-6-50, first removing and burning all infected wood. Give a second spraying in two weeks.

Crown Gall.—It seems to be pretty well established that crown gall can be avoided by proper grafting and handling in the nursery where the trees are produced.

In purchasing trees reject those with galls.

Blackberry

Anthracnose.—Remove affected plants. Just before the buds open spray with Bordeaux 5-5-50 and add 1 pound of rosin fish oil soap. Two weeks after blossoms fall apply a mixture as follows: 2 pounds copper sulphate, 3 pounds washing soda, 2 pounds soap, 100 gallons of water.

Crown Gall or Root Gall.—Plant only disease free plants. Dig up and burn all bushes in a diseased bed. Plant on new ground.

Orange Rust.—Dig up and burn infested plants.

Carnation

Rust.—Make cuttings from healthy plants. Cut off diseased foliage. Spray every two weeks with 1 pound copper sulphate to 20 gallons of water. Do not wet foliage in watering.

Cherry

Brown Rot.—Attacks flowers, leaves and fruit of the cherry and other fruits, the fruit rotting on the tree. Dust with sulphur or spray with lime sulphur 1-50. It is advisable to dust with sulphur a few days before harvesting to reduce loss after crop is harvested.

Black Knot.—Cut out the diseased spots before the first of March and burn all material removed. Spray with Bordeaux. Remove all wild cherries in the vicinity.

Leaf spot, shot hole fungus, etc. The leaves become spotted and fall. The spots drop out and leave shot holes. Spray with lime sulphur 1 gallon solution to 40 gallons of water or with Bordeaux 3-3-50. Three or four sprayings may be required at intervals of two weeks. Dusting with sulphur is used successfully by some growers.

Powdery mildew is often troublesome in nurseries. Dust heavily with sulphur or spray with lime sulphur, 1 gallon of solution to 50 gallons of water and add 3 pounds of iron sulphate.

Cranberry

Scald or Blast.—Causes the flowers to blast and attacks the fruit, giving it a watery appearance. Spray with Bordeaux 5-5-50 adding 4 pounds of fish-oil soap. Beginning early in June, five applications should be given, two weeks apart.

Rots are controlled by spraying as for scald.

Some growers claim that the use of Bordeaux or arsenicals is injurious to the plant roots.

Currants

When the plants are dormant, spray with lime sulphur for scale insects. As soon as the blossoms have fallen and the fruit is formed, spraying with Bordeaux 4-4-50, adding 2½ pounds of arsenate of lead paste will control currant worms. Cover the plants thoroughly. This will control anthracnose and leaf-spot.

Cane Blight.—A fungous disease causing the canes to die suddenly. Go over the bed frequently and cut out and immediately burn all affected canes.

Gooseberry

Leaf spot attacks gooseberries and currants. Spray with lime sulphur 1-50 or Bordeaux 4-4-50.

Gooseberries are sprayed for scale during the dormant season with lime sulphur 1-50. As soon as the berries are formed use lime sulphur 1-40 with 2 pounds of arsenate of lead added and apply again as soon as the berries are harvested. These sprayings will control mildew.

Mildew can be effectively controlled by spraying with potassium sulphid, 1 ounce to 2 gallons of water, but this will not be necessary if the plants are sprayed as suggested above.

Rust can be controlled by spraying as suggested.

Grape

Anthraxnose.—Dark spots appear on fruit and deep pits with elevated margins on canes and on the veins of leaves. Spray with sulphate of iron 100 pounds to 50 gallons of water before the buds open. Cut out affected spots. The spray given for black rot will keep anthracnose under control.

Black Rot.—Most troublesome east of the Rocky Mountains, particularly in the South. Brown spots appear on the leaves and on the half-grown fruit, which becomes hard and black. Sunken pits appear on the canes. The dried berries hang on the vine, carrying the disease over winter. Spray with Bordeaux 4-4-50 as soon as the third leaf has unfolded; again as

soon as the blossoms fall, when the berries are well formed, and again ten days later. More applications may be needed in wet seasons.

Dead Arm.—Causes a dry rot. It starts in the shoots and is spread by the pruning tools. Cut off the stem well below the diseased area and burn the prunings. Spray as for black rot.

Downey Mildew.—Attacks leaves and fruit. Spray as for black rot.

Powdery Mildew.—Dust with sulphur as soon as flowers have dropped and again as soon as the fruit begins to form and later as may be required.

Ripe Rot or Bitter Rot.—Similar to bitter rot in apple. Spraying as for black rot will keep it under control.

Hollyhock

Anthracnose and **Rust** are the principal diseases of the hollyhock. The first is distinguished by brown spots on leaves and stems which gradually spread until the whole leaf is killed.

Rust is indicated by brownish pustules on various parts of the plant. Clean cultivation should be given. Remove and burn all diseased leaves. Spray with Bordeaux 4-3-50 as soon as new growth starts in the spring and continue weekly until flower stalks are well developed.

Horse Chestnut

New Jersey Agricultural Experiment Station.

Horse Chestnut Leaf Blotch.—The horse chestnut is susceptible to leaf blotch. This causes large areas on the leaves

to turn brown, and finally causes some of the foliage to drop. Small black dots scattered over the affected areas are fairly abundant. These dots are the summer fruiting bodies of the fungus parasite. When the leaves drop, the fungus continues to develop in the dead leaves on the ground. In the spring the new spores are ready to infect the leaves as soon as they appear. Later in the season the spores are washed from the diseased to healthy leaves, in this way spreading the infection to all parts of the tree.

If only a few trees are planted on a lawn, it is possible to rake up and burn the leaves as fast as they fall. If every fallen leaf were destroyed, there would be no source of infection for the following year.

Spraying with lime sulphur diluted 1 to 40 or dusting the trees with sulphur-lead arsenate dust; sulphur 90 parts, arsenate of lead 10 parts, is suggested as a practicable control measure where the trees are valuable enough to justify the expense.

In nurseries where young trees are grown, dusting with the 90-10 dust, using a hand duster, has proved very effective. On large trees a power machine is necessary. Many cities own such power sprayers or dusters, which might be used. The first application should be made soon after the buds open, and at least two more applications made at 2 or 3-week intervals.

Maple

New Jersey Agricultural Experiment Station.

Maple Leaf Scorch.—Maples are susceptible to leaf scorch because they come out early and quickly bear large, thin leaves, unprotected by a hairy covering. The trouble may appear as a streaking between the veins, followed by a yellowing of the entire leaf, or as blotches which vary greatly in size and shape. The leaf scorch is especially severe on sugar

and soft maples and the red Japanese varieties, and is most common on trees growing in the narrow strip of soil between the sidewalk and the paved street. The Norway and Red maples are less susceptible, but even these may become severely scorched during a dry period accompanied by hot, drying winds, or when located in very unfavorable positions.

The cause of this condition in midsummer is usually due to the lack of water balance in the tree. Under normal conditions there is a balanced condition between the amount of water taken in and that given off by a plant. If for any reason this balance is disturbed the tree will show an abnormal condition. In the spring, when the ground is cold and the roots inactive, a few warm days may cause the leaves to unfold quickly when they partially exhaust their supply of water, and the parts farthest from the veins are unsupplied. A similar injury may be produced during a dry summer, when the leaves give off an excessive amount of water. In severe cases the whole leaf may die.

The most satisfactory treatment for trees that may be injured by leaf scorch is the removal of 25 per cent. or more of the foliage by cutting the branches close to the trunk. If the pruning is done carefully it will not injure the appearance of the tree. All cutting should be done during the winter, when the wood is dormant.

In the spring the soil should be stirred and a good grade of fertilizer applied.

When the hot dry weather arrives, the soil for some distance about the tree should be watered at regular intervals. Water should not be applied once or twice and then the tree permitted to suffer through the remainder of the drought. This may only augment the trouble. Nor should the water be applied lightly and frequently but rather heavily and at longer intervals, so that the subsoil will have water that is available to the roots.

Peach

Blight.—Affects buds and twigs and the fruit drops. Troublesome in California. Bordeaux 5-5-50 or lime sulphur 1-10 is used. The first application is given in November or December and the second in February or March.

Brown Rot.—Occurs on peaches, plums, apricots, cherries, apples and pears. Attacks foliage, buds, flowers, fruits and limbs of trees. Diseased fruit will hang all winter on the trees and carry the disease over or it may winter in cankers on the wood. Spray with self-boiled lime sulphur 8-8-50, as soon as the buds show pink, again every two weeks until four or five applications have been given. The last spray to be given at least a month before harvesting time. Gather up and burn fallen fruit that is diseased.

Leaf Curl.—The spores winter on the scales of the buds. This disease can easily be controlled by thorough spraying, covering every bud. Spray with Bordeaux 4-4-50 or lime sulphur 1-15. Give an application in the autumn after the leaves have fallen or in the spring before the buds swell.

Leaf Rust.—See Plum.

Little Peach.—Resembles yellows. Produces small fruit that matures late. Troublesome in the North. Causes death of trees and spreads rapidly. There is no known remedy. Dig out and burn the trees completely as soon as the trouble is discovered.

Big Peach has appeared in the East. No known remedy. Dig and immediately burn trees as soon as the trouble is discovered.

Powdery Mildew.—A powdery growth on leaves and fruit. Same treatment as for brown rot.

Root Gall, Crown Gall, etc.—A nursery disease which is controlled by proper grafting. Decline stock that shows symptoms.

Rosette.—Troublesome South. Treatment as recommended for yellows.

Scab.—Causes black spots on fruit. The treatment is the same as for brown rot.

Yellows.—An old trouble that has never been solved. It is not known what “yellows” is, or its cause, and no remedy is known, other than to obtain healthy stock for planting, plant in good soil, cultivate and fertilize well, but do not over fertilize. Dig and burn all affected trees immediately when the trouble is discovered.

Pear

Blight.—Fire Blight.—Attacks pears, apples, quince, hawthorn, etc. The bacteria flow in the sap and prompt attention is needed to prevent spreading. Sticky drops work through the bark in the spring and are transported by insects and other means. The leaves turn black. The blossoms are affected, twigs may blight and cankers which may kill the tree are produced on the limbs.

Clean out old, useless apple, pear and other trees; have no wild hedge rows. Cut out diseased wood as soon as seen and be on the watch for it. Cut a foot below the affected part and treat the wound with a disinfectant and disinfect the tools

after each cut is made. Too much care cannot be exercised. Cut out all cankers in the body and main limbs with a sharp knife, draw-shave or chisel.

For disinfectant use one corrosive sublimate tablet to one pint of water. Another good disinfectant is one-half per cent potassium iodine solution, plus one per cent iodine in denatured alcohol. The Seckel pear seems less subject to attacks than others. Paint the wound at once with coal tar and renew the dressing every year or two. Inspect young trees every few days during summer. Inspect all trees carefully in the autumn and again in the spring before the blossoms open. Remove all water sprouts from the trees several times during the season. Keep insects under strict control.

Leaf Blight.—Attacks leaves and fruit. Causes brown spots on leaves which spread and cause the leaves to fall, also cause the fruit to crack. Spray with Bordeaux 4-4-50 as for scab, giving an additional application.

Leaf Spot.—Small spots appear on the leaves and cause them to fall. The fungus lives over winter on the leaves. Gather and burn fallen leaves. Spray with Bordeaux as for scab.

Scab.—Brown or black spots on leaves and fruit, sometimes causing fruit to crack. Winters on infested twigs. Spray with Bordeaux 4-4-50 as the blossoms show pink, again as soon as the blossoms fall, then two weeks later. Other applications may be required by unfavorable weather.

Rust.—Similar to apple rust, which see. Spray as for scab.

Plum

Black Knot.—Affects plums and cherries. A black tumorous swelling on limbs and twigs. Burn all affected parts in the

autumn, cutting out several inches below the swelling on small limbs. Badly infected trees should be cut down immediately and burned. Some states have a law requiring this and it should be lived up to.

Brown Rot.—Attacks leaves, flowers, fruits and shoots. Treatment same as for brown rot under peach.

Rust.—For treatment see leaf-curl under peach.

Powdery Mildew.—Spray with lime sulphur as for brown rot of peach.

Shot Hole Fungus.—**Leaf Blight.**—Treat as for leaf spot of cherry.

Sunscald.—Head trees low to keep the trunk shaded.

Quince

Curculio.—Spray with 3 pounds of arsenate of lead paste to 50 gallons of water. Apply as soon as the beetles appear and again a week or ten days later.

Black Spot.—Attacks fruit and foliage. Black spots appear on the fruit causing it to become hard, producing a dry rot.

Spray with Bordeaux before the blossoms open and again as soon as they fall.

Rust.—For control see apple rust.

Borers.—Worm them out early in the season, along the latter part of May and again late in September.

Codling Moth.—Arsenate of lead combined with the Bordeaux will control the codling moth and curculio. Two additional sprayings of Bordeaux may be required later in the season. See under apples.

Raspberry

Anthracnose.—Indicated by gray spots on the canes. Be careful not to take plants from diseased beds. Remove all diseased canes and burn as soon as fruit is picked. Make new plantations on new land. Plants should have plenty of room for air and light. Always remove old canes after harvest. This is good practice always as it increases the following year's crop.

Cane Blight.—The leaves wilt and canes die. Treat as for anthracnose.

Crown Gall.—Swellings or growths on roots close to the soil. Contagious; will also spread to peaches and infected land will remain so for many years.

Never use plants, however clean, from affected fields. See crown gall of peach.

Red or Orange Rust.—A red, powdery growth on under side of leaves, more often on black raspberries and blackberries. The fungus lives over in the roots. There is no remedy. Dig up and destroy infested plants.

Rose

Well grown roses are not subject to many diseases and poorly grown, sickly plants are not worth bothering with. Give roses outdoors a fully exposed position, good soil and plenty of

fertilizer such as cow manure, bone meal in not too large quantities and water as needed, and the result will be thrifty plants, if they are kept free from insects.

The only troublesome disease is likely to be mildew. Dust with sulphur flowers or spray with potassium sulphid, one ounce to three gallons of water.

Strawberry

Leaf Spot.—Give good soil drainage and plenty of air. In making beds obtain plants free from the disease if possible. In any case remove all diseased leaves and burn them before the plants are taken to the field. Spray with Bordeaux 4-4-50 as soon as growth starts and follow with three additional sprayings during the season. The value of spraying is doubted by some large growers.

Mildew.—Appears on foliage and fruit. Spray with potassium sulphide, one ounce to two gallons of water. Bordeaux will control the trouble in some cases.

Rots.—The remedy for rots is to pick fruit on time and to cover it as soon as picked and keep it protected until loaded for shipping. Have all ripe or rotted or bruised berries discarded. Use a spring wagon in moving fruit. Have the packing shed kept clean, burying all rotten fruit.

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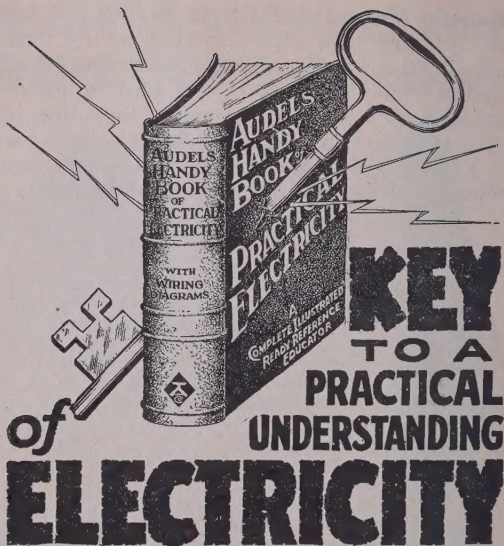
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- How to distinguish clays.
 - How bricks are made.
 - How to fix mortar.
 - How to use bricklayer's tools.
 - How to handle the materials.
 - How to lay brick.
 - How bricks are bonded.
 - How thick brick walls should be.
 - How to brick around openings.
-

- How to lay out arches.
 - How to place anchors.
 - How to build foundations.
 - How to brick up boiler settings.
 - How to build chimneys.
 - How to do ornamental brickwork.
 - How to repair old brickwork.
 - How to figure brickwork.
 - How to handle hollow tile.
 - How to set tile.
-

- How to mix concrete.
 - How to operate the mixers.
 - How to place concrete.
 - How to make concrete forms.
 - How concrete is reinforced.
 - How to build stucco.
 - How to build with concrete blocks and tile
 - How concrete is made waterproof.
 - How to estimate.
-

- How to read blue prints.
- How to lay out foundations.
- How to plaster.
- How to do stone masonry work.
- How to use structural steel.



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